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THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY[1]

INSTALLATION ADDRESS

By Dr. SAMUEL W. STRATTON

RETIRING PRESIDENT AND CHAIRMAN ELECT OF THE CORPORATION

THE administration of the affairs of a large educational institution has become in many respects as great a problem as that of industry. The interests of the former are generally more diversified, its organization more complex and its administration more difficult, from many points of view.

Academic freedom, which generally refers to one's right to an opinion in his own field and to teach accordingly, is often interpreted to cover a much wider range of subjects, hence we do not always find the team work in the faculty that is found in industry or in the football team. In an institution like this, the coordination of the work between departments having many common interests is one of the most important phases of administration.

Notwithstanding the many interests common to all the scientific and technical departments, there is necessarily a great diversity between them in the later years of the courses and in graduate work.

At the institute there are twenty or more undergraduate courses and options leading to degrees. In all these graduate work is going on and growing rapidly. The inter-departmental relations as to this advanced work involve administrative problems of great importance.

Every department depends upon others for instruction in some of the subjects included in its own curricula. Few research projects are taken up that do not involve cooperation as to personnel and equipment between different departments. Conditions set up for convenience in departmental organizations are not always those most favorable to investigational

[1] Addresses given at Cambridge, Massachusetts, June 6, 1930.

work. Our course in engineering administration has shown conclusively that an engineering training supplemented with the fundamentals of business is an excellent preparation for the work of administration, especially in industry.

In every group of men entering the institute, some men are found who are by nature fitted for this class of work, and special training is provided for them. Others are endowed with the spirit of discovery; when the training of these is supplemented by advanced mathematics and science, they often become research men of the highest type. To discover these types of men and prescribe suitable courses of training for them is a most important educational problem. Men succeed best when following an occupation they enjoy.

To adjust the grade of each man's work in accordance with his ability rather than a fixed minimum as a standard for all is essential to efficiency in education if we are to do the best by the men. Some can accomplish much more than others with the same effort. Why not give them the opportunity?

A question of major importance in the administration of the affairs of a professional school is that of interesting successful men in the training of those who are to follow in their professions. Among the graduates of the institute are to be found many of the foremost leaders in all the branches of science and technology with which it is concerned. These men can and do contribute the benefit of a wealth of experience. To encourage and foster this sort of contact is worthy of our most serious attention.

Cooperation with industry in this same respect is also important. Industry as well as the professions should assist in preparing the specifications of the types of men they need, and which we are in the business of training. The cost of training men in science and technology is much greater than is generally understood. When one of the early English physicists was asked by a visitor if he might see his laboratory, the physicist called a servant and directed that the laboratory be brought in. Contrast this with the great modern research laboratories, educational or industrial, with equipment for undertaking the most delicate investigations, or those requiring huge compressors, furnaces, generators or other facilities necessary to produce the conditions which the scientist of to-day must have at his disposal.

By far the most serious problem confronting an institution training men in the fields of science and technology is that of maintaining a suitable instructing staff; men who are leaders, and who inspire in others the same qualification.

During the past decade or so, many industrial concerns have learned what a few discovered earlier—the value of scientific research. During this period large numbers of young scientists have been taken into industry where they are rendering valuable service, much of it research of the highest order. Hence the supply of such men now available for educational work is very small. Naturally this demand has raised the pay of competent scientific men nearer to what they are worth and which educational institutions must meet by better pay, and especially by conditions favorable to original investigations.

It is encouraging to note that some concerns are cooperating with educational institutions in the maintenance of instructors and equipment in order to insure a supply of men who often become their most valuable asset.

To meet the mounting costs of a technical education the institute has twice raised its tuition in the past four years, which now covers about one half of the cost of instruction and expenses accessory thereto, not including buildings. We at the institute do not forget that the buildings about us and their equipment were provided for in the most part by men who are grateful for their own training and those who appreciate the part the graduates of the institute have taken in the building up of great industries.

The founders of the institute saw with prophetic vision and provided for the relation that must exist between instruction in technology and that of the basic sciences involved. They realize that progress in the fields of applied science goes hand in hand with the discovery of fundamental principles. Their most vivid imagination could not have forecast the growth of science and the consequent development in the fields of technology. Out of physics have grown:

Electrical engineering with many subdivisions, rigidly exacting as to the most advanced modern physics for a foundation.

Aeronautical engineering with its basic aerodynamics.

Modern hydraulics, involving hydrodynamics.

Geodesy, the most precise form of surveying.

Developments in steam and internal combustion engines, applications of the principles of thermodynamics.

Out of chemistry have grown:

Chemical engineering, the adaptation of chemical processes to production on a large scale. The petroleum industry owes it present success to the chemical engineer.

Physical chemistry, involving the most precise measurements of physics in the determination of constants and laws upon which progress in the science of chemistry and its application depends.

Refrigeration engineering, based upon the laws of heat transfer.

Electro-chemistry, dealing with reactions at high

temperatures so essential in metallurgical and other industrial processes; also the conditions under which metals are deposited electrolytically. Out of these great industries have sprung up as if by magic.

The cryogenic field is one in which both physics and chemistry are brought to bear in the production of low temperatures, the liquefaction of gases, the production of gases essential in both science and industry. The striking laboratory experiments of a decade or two ago were the forerunners of great industries of to-day.

In the field of metallurgy, applications of physics and chemistry form one of the newest and most important branches of science and its applications. The metallurgist juggles with metals and produces mixtures at will with almost any given properties, without which many modern industrial developments would have been impossible.

This is true to an amazing extent of all the materials we use, the bricks with which we build the refractories that line the furnaces of industry, the finest porcelain, the cement, the glass and all the materials of construction.

The fuel question is the most important of the automotive industry. The clothes we wear and the papers we read involve the use of scores of materials. In connection with the use and production of all these materials, new fields of technology have arisen based upon physics and chemistry of the most fundamental nature.

It is becoming difficult to classify science as pure and applied. Engineering and technology involve the most difficult problems in the fields of pure science. Industries are calling for and producing the most fundamental scientific data. Hence, in the training of men we must not overlook the intent of the founders of the institute as to the relations between the basic sciences and technology even though each has advanced far beyond their most sanguine vision.

To maintain the ideals of the founders and the best traditions of the institute, they must be interpreted in the light of modern science and the problems of the day. All its functions must be carried on in an atmosphere of research, if it is to be a blazer of trails to new fields and not merely the follower of beaten paths.

Recognizing these facts, the corporation has adopted a plan of organization which will permit of the administration of the affairs of the institute in accordance with the requirements of the present, and the conditions under which it can perform its functions most efficiently. This new plan provides for both a chairman of the corporation and a president of the institute; heretofore the latter has served in both capacities. In the present case the retiring president becomes chairman of the corporation, who at this time wishes to express his great appreciation of the support given him as president and the hope that these friendly, helpful relations will continue while he is its chairman.

Alumni and Friends of the Massachusetts Institute of Technology:

I have the honor of presenting to you the choice of the corporation for the next president of the Massachusetts Institute of Technology—Professor Karl Taylor Compton, chairman of the department of physics at Princeton University—eminent investigator in the field of physics, with a long list of original contributions to knowledge in this branch of science to his credit.

Honored by degrees from many institutions for his brilliant work in science.

Member of the National Academy of Sciences and an active leader in the organized bodies of American scientists.

Sympathetic with the applications of science in the fields of engineering and industry.

Who rendered most important scientific service during the late war.

And above all, a man who is universally loved and admired by all who know him.

To you, President Compton, I commend a corporation composed of successful men actively interested in the affairs of the institute. As its leader I foresee a constructive cooperation with you:

A loyal faculty, appreciative of your leadership,

A serious energetic, self-governed student body, which will be your greatest inspiration.

INAUGURAL ADDRESS

By Dr. KARL T. COMPTON

Permit me to take this opportunity briefly to discuss certain features of the Massachusetts Institute of Technology which have induced me, with real enthusiasm, to cast my lot with you as a part of this new organization. I venture to hope that this is appropriate because the significance of these considerations is not primarily to me personally, but to every one who is interested in science, and in the contributions which science has made and will in the future make to the happiness and welfare of mankind.

The three most pertinent questions in evaluating any institution would seem to be, "What is its pur-

pose?" "What is its accomplishment?" "What is its future?" It is through its answers to these three questions that the Massachusetts Institute of Technology commands allegiance and support.

I venture to formulate the purpose of the institute as "the development of science and its useful applications," and to describe the method of accomplishment of this purpose as being "through continual study and research combined with the training of men." This purpose is dictated by the opportunities found in modern science for contributing in such a fundamental way to the necessities of life that it is not surprising that the distinguished founder of this institute, William Barton Rogers, expressed it and recommended the means to accomplish it in words which are every bit as significant to-day as they were when he wrote from Virginia in 1846 to his brother Henry in Boston, outlining his plan for an institute of technology. This was fifteen years before the institute was incorporated and nineteen years before it was actually opened. He says:

> The true and only practicable object of a polytechnic school is, as I conceive, the teaching, not of the minute details and manipulations of the arts, which can be done only in the workshop, but the inculcation of those scientific principles which form the basis and explanation of them; and along with this a full and methodical review of all their leading processes and operations in connection with physical laws.

Dr. Rogers then goes on to outline an organization and a curriculum which are astonishingly like those of to-day, which have stood the test of time and experience. As an example of constructive imagination, good judgment and prophetic vision, I wonder whether there is an equal to this in educational literature!

Turning now to the question, "What has been the institute's accomplishment?" I almost hesitate to attempt an answer, because its direct and indirect influence have been so enormous. As the first category of accomplishment I would mention its alumni. They comprise builders of huge industries, organizers and executives of great companies, leaders in science, engineering and architecture, and a great host of men who are ably engaged in operating and developing the vast industrial system which is the distinguishing feature of our present civilization. And in educational work they have taken an equally prominent part. For example, I recently visited a great Midwestern university in which I found that all four of the deans were Technology men. During the past few months, since I have become so particularly interested in the institute, I have been continually amazed to discover how important a rôle its alumni are playing in the life of the country. There can be no doubt regarding the value and vigor of an institute which has trained such men.

As the second category of accomplishment I would point to the other great technological and engineering schools now scattered all over this country, which are the direct offspring, so to speak, of the Massachusetts Institute of Technology and patterned after the original plan of President Rogers, each with an individuality born of local conditions or of desire particularly to emphasize one or another aspect of the general plan. In thus providing a pattern and also to a very large extent the faculties for these newer technological schools, the institute is in the position of the founder of a sturdy and illustrious family. And this is true not only in this country but also abroad. It is held, for example, that the tremendous technical and industrial development of Germany is due largely to the fact that that country, perhaps more than any other, was quick to grasp the value of President Rogers' ideas and, with characteristic efficiency, to build upon them a nationwide system of technical schools and of industrial development.

As the third category of accomplishment, I would like to suggest simply the present industrial and economic structure of the country. Of course very many factors have entered into this, and the part which the institute directly or indirectly has played is rather undefined but none the less real and of tremendous significance. Time does not permit elaboration of this interesting theme.

And finally, "What of the future?" From past experience and accomplishment we may gain wisdom, guidance and encouragement, but it is the future which vitally interests us. In regard to this future there seem to me to be several outstanding considerations.

In the first place there appears to be no reason for any change in the purposes and ideals of the institute. As I have already remarked, the institute has been devoted in the most fundamental way to the benefit of mankind through science. There is every indication that only a beginning has thus far been made in the science of discovering and understanding nature and in the art of usefully applying this knowledge. I can conceive, therefore, of no more appropriate or urgent program for the institute than simply to continue its work of developing both principles and men for applying science to problems of human welfare. But, although the purpose of the institute is unaltered, I do believe that present conditions indicate the necessity of careful attention to several vital matters.

First I would suggest the necessity of greater emphasis upon the fundamental sciences both in their

own rights and as the bases of the various branches of engineering. As engineering has developed to greater and greater complexities, it becomes increasingly impossible to hope to train men in those exact processes of thought or manipulation for which they will later be called upon. And as scientific discoveries and applications are ever increasing at an accelerated rate, there is ever-increasing probability of meeting problems far off the beaten trail. Also many who start in as engineers later become executives or administrators. In all such situations a broad and thorough training in fundamental principles gives much greater power than a training in details which may seldom be encountered in practice. Again, whereas a generation ago most of our great technical industries were in their infancy and needed many men trained in the details of their respective arts, now most of these industries are large organizations which are equipped and prefer to train their own men in the fine points of their art: they absolutely require, however, men who come with a sound basis of training in fundamental principles. The institution which supplies these men supplies the men destined to leadership.

Every application of science presupposes a discovery of science to be applied, so that the useful applications of science are in the last analysis limited by the extent to which scientific research has been successful in uncovering the hidden forces of nature. Then, when these scientific discoveries are put to the service of man, there is always a limit to the available extent of this service—a limit set by some such thing as a defect of material, inability to solve an equation, or some disturbing factor. So here again it is the province of research to push back or remove these limitations. While, therefore, in its humble beginnings, the greatest service of an institute of technology might very well have been to acquaint men with the laws of science and the technique of their application, an institute of technology to-day, to perform its greatest service, must take the lead in actually developing science and its applications as well as in technological instruction. In fact no proper or adequate teaching in these days can be done except as it is permeated with the spirit of research, for every constructive activity of life which is not mere routine consists of the continual endeavor to solve problems, in which broad training in fundamental principles and the inculcation of the true spirit of research constitute the best possible preparation.

I hope, therefore, that increasing attention in the institute may be given to the fundamental sciences; that they may achieve as never before the spirit and results of research; that all courses of instruction may be examined carefully to see where training in details has been unduly emphasized at the expense of the more powerful training in all-embracing fundamental principles. Without any change of purpose or any radical change in operation, I feel that significant progress can thus be made.

Second let me emphasize the supreme necessity of maintaining a faculty of absolutely first-grade men, despite the increasing difficulty of doing so. Here, as in every organization, the question of personnel is the supreme issue. But, unlike other organizations, an educational institution can make a perfectly logical and unanswerable argument that its need of the best men should supersede the claims of any other organization. For it is these men in the educational institutions who train and inspire all the others; their abilities are renewed and made available to the world in every graduating class. The folly of sending our youth to second-rate teachers in the hope of obtaining a first-class training is too absurd to discuss. And yet this is a very real danger, for industry is competing with universities for the best men, often taking them and then perhaps later finding fault with the institution for not giving its students a first-class training! I could go on at great length on this topic, which is one so easy to argue, yet so difficult practically to solve.

Several things, I believe, conspire to make this situation so serious. Industry can outbid an educational institution for a man if it wishes to do so. An industry may be short-sighted, looking only to its profits for the next few years. Or it may realize the situation and, if left to itself, would not try to take a certain man from an educational institution—but realizing that if it does not some competing concern will, it proceeds to invite the man to join its staff. There are instances in this institute in which an industry has taken man after man from key positions, leaving a department seriously embarrassed, crippled and criticized. (In fairness I should say, on the other side, that this demand for men by industry is stimulating and is really an evidence that the institute has been successful. It would, to my mind, be nothing short of a calamity if the demand by industry for men on the faculties were to cease.)

How, then, is this complicated situation to be handled? I doubt whether any rules, agreements or other artifices can hope to solve it. The solution must be found, I think, according to the regular economic laws, that is, by the institute's being in a position to offer to the man it needs a sufficient emolument in salary and advantages to hold him or, failing that, to secure another first-class man in his place. And the industries must, for their own ultimate self-interest, see to it that the institute is financially

able to retain on its staff the leaders in the various scientific and technical professions.

It has been well said that "civilization is measured by the ability to forego present pleasures for the sake of future benefits." In regard to the point which we have just been discussing, it is certain that only a few of our leading industries can be said on this basis to be civilized at all. Had it not been that many individuals have, by their generosity and vision, proved themselves "civilized" to a high degree, our technological institutions and the industries which have been so indebted to them would both now be in a pitiable state.

Just how industries can be brought to bear a fair share of the expense of giving first-class training to the men on whose discoveries and work they largely exist is a problem for the future. Certain it is, however, that its satisfactory solution would greatly accelerate the rate at which science and industry can contribute to the comforts and opportunities of life. In any case, however, the problem of personnel and financial means to maintain it at a high standard is one which presents a serious challenge.

The third problem of the future to which I should like to call attention is one which is not so fundamental as the two just discussed, but which is nevertheless very important and interesting. It is the problem of finding the most advantageous way in which the institute can cooperate with technical industries in the solving of their problems. As you know, a great step in this direction was taken with the inauguration of the so-called "Tech plan" and the formation of the division of industrial cooperation and research. Very valuable work has been done under this plan, but it has also had certain unsatisfactory features. I know from personal experience that contact of a university teacher with the practical problems of an industry can be professionally extremely stimulating and valuable. And certainly the institute should render every assistance in its power to any worthy cause within the range of its interests. The problem really consists in improving, if possible, the way in which this aid is rendered so that it may be not only as effective as possible in regard to the object of the assistance, but also done so as not to interfere with the other more fundamental activities of the institute—and if possible done so as to aid them. This problem is one requiring both study and wise counsel. Like every good problem, it presents opportunities as well as difficulties.

These problems which I have mentioned, and to which others might be added, are simply sign-posts pointing out the directions which our efforts must take in order to do our work most effectively. It is a work whose results will ultimately affect every man, woman and child and which should command the support of all except those few who are timid in the face of power or who for some reason fear to let man understand too much of nature. The Massachusetts Institute of Technology looks to us, who love and respect nature, to work out her future development. I join you in this work because I believe in its value, and for the same reason I feel confident of the cooperation of each of you, according to his position and opportunity. In its direct and indirect influence I can conceive of no more valuable service.

OBITUARY

ERNST CLEMENT ANGST

A CAREER which held every promise of distinction was terminated by the sudden death, on April 18, of Dr. Ernst Clement Angst, assistant professor of botany at the University of Oklahoma.

Dr. Angst was born in Chehalis, Washington, on February 15, 1899, of Swiss and Canadian parentage. He was educated at the University of Washington, receiving his doctorate there in 1929. He was married in 1923 to Carol Lavone Cramblitt, who survives him. From 1923 to 1927 he was a member of the faculty of the University of Idaho at Pocatello. He went to Oklahoma in 1929 and during his few months of service there won the undiluted respect and affection of his immediate colleagues and students.

In addition to published work on marine bacteria he was coauthor with Dr. H. H. Gran, of Oslo, of a monograph on the plankton diatoms of Puget Sound, now in press. At the time of his death he had collected, described and figured 145 species of Oklahoma diatoms nearly all of which were determined. This work will be completed for posthumous publication.

Dr. Angst was an unremitting investigator of the highest type, gifted with a facile and original technique and sound scientific judgment. In addition he was a splendid teacher whose lectures, erudite and methodical, were seasoned with quaint, incisive humor. His colleagues in the department considered it a privilege to listen in when they could, and it was not an unusual sight to see an entire class on the edges of its chairs. There is no question that a few more years would have seen Dr. Angst rated, not only as a great diatomist, but as a great teacher of botany.

PAUL B. SEARS
R. E. JEFFS
ADRIANCE S. FOSTER
R. H. MOORE

RECENT DEATHS

DR. W. S. FRANKLIN, who retired last year from the professorship of physics and electrical engineering at the Massachusetts Institute of Technology, was killed in an automobile accident on June 6. Dr. Franklin was driving north from Florida, where he had served during the winter as visiting professor at Rollins College. He was sixty-seven years old.

DR. A. R. CROOK, who for twenty-four years has been chief of the Illinois State Museum at Springfield, Illinois, died on May 30 at the age of sixty-six years.

DR. H. J. B. FRY, pathologist at the Cancer Hospital, London, died on May 5 from an infection acquired at a post-mortem examination. He was forty-four years of age.

MEMORIALS

To commemorate the life and work of Dr. Herbert Steuer, on the second anniversary of his death, the Steuer Memorial Prize was awarded to William A. Sommerfield, a junior in the School of Medicine of Western Reserve University. Dr. Steuer was electrocuted on June 6, 1928, while making an X-ray examination of a patient. Friends of his established the memorial, the income from which goes each year to an investigator who does meritorious work in the department of anatomy of Western Reserve University.

THE Cole Library, in memory of the late Professor Alfred Dodge Cole, in the Mendenhall Laboratory of the Ohio State University, was opened for the use of students and faculty, with the spring quarter. The library will be supported by a fund of $50,000 which is being collected by engineers and other alumni who are particularly interested in physics. More than $22,000 has already been pledged.

SCIENTIFIC EVENTS

THE PROPOSED SUBTROPICAL NATIONAL PARK IN FLORIDA

SECRETARY WILBUR, of the Department of the Interior, has announced that the departmental committee of experts designated by him to make an examination of the availability of the Everglades in the Cape Sable region of Florida for a suptropical national park has completed its investigation, and would report that the project measured up to the high standards prescribed for national park establishment.

He stated that the prospective educational value of the area equals at least, if it may not exceed, that of any existing national park, and that the area should be preserved to protect the primitive character of the country and its abounding wild life so that it may be enjoyed in its natural state by future generations as well as those of our time. For these reasons, he said, he would himself recommend it to Congress for approval as a project.

The committee of experts consisted of Director Horace M. Albright and Associate Director Arno B. Cammerer, of the National Park Service; E. K. Burlew, administrative assistant to the secretary, and acting as the latter's personal representative; Superintendent Roger W. Toll, of the Yellowstone National Park; Dr. Hermon C. Bumpus, of the American Association of Museums; Dr. T. Gilbert Pearson, president of the National Association of Audubon Societies, and Dr. M. W. Stirling, chief of the Bureau of American Ethnology.

The detailed official report embodying the committee's recommendations is in course of preparation. The announcement says:

> The Cape Sable region of Florida, site of this prospective national park, is fifty miles nearer the equator than any other section in the United States and presents an area of tropical America in flora and fauna encountered nowhere else in the United States. One interesting observation made generally by the members of the committee was that their original conception of the Everglades as an impassable tropical jungle, festooned with lianas and with miasmatic swamps, full of alligators, crocodiles and venomous snakes, was entirely shattered by their views of extensive coastal prairies and tropical hammocks. The inspection was made by dirigible, and by motor boats and skiffs.

EXPEDITION TO GREENLAND OF THE UNIVERSITY OF MICHIGAN

PROFESSOR WILLIAM H. HOBBS, of the geology department of the University of Michigan, while remaining in Ann Arbor, will direct a fourth expedition to Greenland, made possible through a recent gift of $5,000 by the Carnegie Institution of Washington for a twelve months' continuance of earlier studies. Professor Hobbs will direct the work partly by wireless.

Plans are under way for the establishment of two aerological stations—one in Ivigtut, on the western coast of south Greenland, and another in Anmagssalik, in southeastern Greenland, both south of the Arctic Circle. The Michigan observers will cooperate with Professor Alfred Wegener, who has already reached Greenland at the head of a large expedition which includes twenty scientists.

Professor Wegener will establish three similar stations stretching in a line across the ice cap of Greenland in the latitude of Umanak. One of these stations will be situated on the top of the ice cap and near the remote center of the continent. All five stations will

be operated simultaneously for the period of a year, affording, for the first time, a comprehensive study of the circulation of the atmosphere above Greenland—the glacial anticyclone. The work of Dr. Wegener has been stimulated by that of the University of Michigan Greenland Expeditions and will be devoted to the same end.

Evans S. Schmelling and William S. Carlson, of the department of geology, both of whom have taken part in the former expeditions to Greenland, will be sent to the two stations. The American-Scandinavian Foundation recently awarded to Mr. Carlson a scholarship which will enable him to study, in connection with his other scientific work, the possibilities for establishing a seaplane station on the northern airplane route to Europe. Max H. Demorest, of Flint, Michigan, will accompany the two members of the expedition, as assistant.

Necessary instruments for the work will be loaned by the United States Weather Bureau. Transportation for Mr. Schmelling has been planned through the cooperation of the Pennsylvania Salt Company, operators of a ship ore line between Philadelphia and Ivigtut. The Cryolite Mining Company, which operates a mine at the site in Greenland, will provide his food and living quarters for the year.

On all clear days members of the expedition will send up pilot balloons and follow their paths with the theodolite so as to discover the force and direction of the wind at all levels up to the place the balloon passes out of sight. Dr. Wegener will be sending out similar pilot balloons at his stations.

THE PAN-AMERICAN AGRICULTURAL CONFERENCE

North America will meet Latin America in Washington next September for discussion of the problems of agriculture that affect or are common to the two continents. Officials of the U. S. Department of Agriculture, which is cooperating with the Department of State and the Pan American Union in preparing for this Inter-American Conference on Agriculture, Forestry and Animal Industry, believe it promises to be at least as important as any previous gathering for any other purpose in which the two continents have joined forces. The conference, which will be held at Washington from September 8 to 20, will be devoted to practical problems of agriculture, giving special attention to agricultural problems of an economic and scientific nature.

Called in accordance with a resolution of the Sixth International Conference of American States at Havana in February, 1928, the coming assembly will be the first Pan-American gathering to deal exclusively with questions related to agriculture. This subject has been on the program of several of the Pan-American scientific and commercial congresses, and a group of the nations concerned has discussed various phases of the problem at other meetings, but at no previous conference has an attempt been made to cover such a wide range of agricultural topics or to consider in such a comprehensive way plans looking to the scientific and economic development of agriculture and its related industries throughout all the nations of the Americas.

Problems of inter-continental concern will be discussed in their broadest scope and with a view to formulating basic plans for effective continental cooperation in the development of the agricultural industries. Both governmental agencies and private organizations will participate, and the conference will endeavor to promote cooperation between governments and private citizens in the study of the problems presented.

The conference will consider broadly the problems of research in agriculture and forest development and methods of preventing and eradicating diseases and pests affecting plants and animals. Sponsors of the conference also anticipate that in discussing agricultural economics the members will explore the problems of competition which are now beginning to bear heavily on the nations in the tropical and subtropical regions of this hemisphere. Tropical countries of other continents now offer growing competition in production of such products as rubber, coffee, sugar, cacao, cotton and other vegetable fibers, tobacco and citrus fruits. In many of these products the new world formerly enjoyed practical freedom from competition.

The conference will also consider plans looking toward a coordination of research work by groups of the American nations acting in harmony to improve and develop the crops in which they have common interests. It will study the latest scientific methods both for the growing and for the marketing of agricultural products.

Reports dealing with the various questions on the agenda have been prepared by experts and are now being sent to the national committee in the different countries and to the private associations which are being invited to attend. This will promote advance study in preparation for the discussions at the conference itself, which will be chiefly round-table gatherings.

THE SUMMER MEETING OF THE AMERICAN PHYSICAL SOCIETY

For the first time in many years the American Physical Society will hold a summer meeting. This meeting, which will be held at Cornell University, Ithaca, N. Y., from June 19 to 21, will be in the nature of a "vacation" meeting. Plans have been made to schedule the formal scientific program chiefly

in the morning sessions. The afternoons will be devoted largely to informal conferences on a variety of topics concerning both experimental and theoretical physics and to sports. A picnic dinner will be held one evening in Enfield Glen, a gorge that contains many interesting geological features. One morning will be given over to the presentation of ten-minute contributed papers by members of the society. The remainder of the formal program will consist of invited papers.

At one of the sessions certain features of modern astrophysics will be presented by Dr. S. A. Mitchell, director of the McCormick Observatory, University of Virginia, who will discuss "Atomic Structure under Conditions of Temperature and Pressure found at the Sun's Surface," and by Dr. J. Q. Stewart, of the Princeton University Observatory, whose subject will be "The General Problems of Astrophysics with Special Reference to the Opacity of Gases."

Among recent developments in physics three topics of widespread interest will be considered in papers entitled: "Secondary Structure of Crystals," by Professor F. Zwicky, of the California Institute of Technology; "Improvements in Technique in the Study of the Raman Effect with Particular Reference to Excitation by Single Lines," by Professor R. W. Wood, of the Johns Hopkins University, and "X-Ray Scattering and Atomic Structure," by Professor Arthur H. Compton, of the University of Chicago.

An address that will be of special interest to scientists in general will be given by Sir William Bragg, director of the Royal Institution of Great Britain, who will speak on "Faraday's Diary."

With a limited formal program, it is hoped that those attending the meeting will have an opportunity, often lacking at more crowded meetings, for getting better acquainted and for leisurely discussion of scientific topics.

On the day before the program begins at Ithaca, those attending the meeting have been invited by the Corning Glass Works to be their guests at a luncheon at Corning, N. Y., and to visit the factories at Corning and at Wellsboro, Pennsylvania.

ESTABLISHMENT OF THE INSTITUTE FOR ADVANCED STUDY

PLANS are announced for the establishment and endowment of the "Institute for Advanced Study." The fundamental conception underlying the plans is set forth in a letter addressed by Mr. Louis Bamberger, formerly head of L. Bamberger and Co., of Newark, and his sister, Mrs. Felix Fuld, wife of Mr. Bamberger's late partner, to those who will be trustees of the institute for its first year.

The Institute for Advanced Study will provide facilities with which eminent men of learning may devote themselves to research and the training of advanced students for and beyond the degree of doctor of philosophy or other professional degrees of equal standing. This, therefore, will be exclusively a post-graduate institution.

Mr. Bamberger and Mrs. Fuld propose to provide the institution with an initial endowment of $5,000,000 to which they expect to make further additions to an extent which they hope will provide adequately for the purposes of the institute.

Dr. Abraham Flexner, formerly secretary and director of the Division of medical education of the General Education Board, will serve as the first director of the division of medical education of the the services as members of the faculty and staff of outstanding and most promising teachers in their respective fields.

The institute will be located in Newark or its vicinity. At its inception it will probably occupy temporary quarters while plans for permanent buildings and equipment are being developed, while the faculty and staff are being selected and the organization work of the institute is being effected.

The trustees for the first year are the following:

DR. FRANK AYDELOTTE, president of Swarthmore College.
EDGAR S. BAMBERGER, of Newark, N. J.
LOUIS BAMBERGER, one of the founders.
DR. ALEXIS CARREL, member of the Rockefeller Institute.
DR. ABRAHAM FLEXNER.
DR. JULIUS FRIEDENWALD, of Baltimore, Maryland.
MRS. FELIX FULD, one of the founders.
JOHN R. HARDIN, of Pitney, Hardin and Skinner, Newark.
THE HONORABLE ALANSON B. HOUGHTON, formerly U. S. Ambassador to Germany and later to Great Britain.
THE HONORABLE HERBERT H. LEHMAN, Lieutenant-Governor of New York.
SAMUEL D. LEIDESDORF, of S. D. Leidesdorf and Co., New York City.
HERBERT H. MAASS, attorney-at-law, New York City.
DR. FLORENCE R. SABIN, member of Rockefeller Institute.
PERCY S. STRAUS, of R. H. Macy and Co.
DR. LEWIS H. WEED, dean of the medical faculty of the Johns Hopkins University.

SCIENTIFIC NOTES AND NEWS

A PORTRAIT by Mr. Ralph Clarkson of Professor Eliakim Hastings Moore, head of the department of mathematics in the University of Chicago, given to the university by his former students, colleagues and friends, will be hung in the new Eckhart Hall of Mathematics, Physics and Astronomy.

At the commencement of the University of California, the honorary degree of doctor of laws was conferred on Florian Cajori, the historian of mathematics, on Harvey Wiley Corbett, the architect, and on Frederick Hanley Seares, the astronomer.

The University of Oxford will confer on June 23 the honorary doctorate of science on Sir Arthur Keith.

Professor Alfred Hettner, of the University of Heidelberg, is the twenty-seventh recipient of the Cullum Gold Medal of the American Geographical Society, New York City. The medal is awarded from time to time to those "who distinguish themselves by geographical discoveries or in the advancement of geographical science." Presentation of the medal will be made at the University of Heidelberg by Ambassador Sackett, who will represent the society.

Dr. Carl E. Guthe, director of the Museum of Anthropology at the University of Michigan, was awarded the Lapham Medal for distinguished service in anthropological research at a meeting of the central section of the American Anthropological Association held in Milwaukee on May 10.

Professor M. L. Fernald, of Harvard University, has been elected a member of the Societas Phytogeographica Suecana. Professor Fernald will spend the summer in England and France, studying types of American plants. In August he will read an invitation paper at the fifth International Botanical Congress at the University of Cambridge.

Present and former students of Dr. Wilder D. Bancroft, professor of physical chemistry at Cornell University, are planning a testimonial dinner in his honor on Saturday, June 21, at Ithaca. This dinner will be given after the close of the Colloid Symposium.

Dr. Frank Billings will be the guest of honor at a banquet to be given by alumni of Rush Medical College at the Statler Hotel in Detroit on Wednesday, June 25, at 7 p. m. Moving pictures of the old Rush Medical College and of the new University of Chicago medical buildings, of the faculty and of the alumni will be shown.

The board of managers and the medical advisory board of the National Jewish Hospital at Denver gave a dinner on May 27 in honor of the seventy-fifth birthday of Dr. Henry Sewall, professor of medicine emeritus in the University of Colorado.

The insignia of a knight of the first class of the National Order of St. Olaf has been conferred on Dr. Augustus Trowbridge, dean of the graduate school of Princeton University, by Haakon VII, King of Norway, in recognition of his work in assisting the Norwegian government to obtain funds from international sources for the erection of the Arctic Observatory.

The president and council of the Royal Society have recommended the Prime Minister, Mr. MacDonald, and General Smuts for election into the society under the special statute which permits the election of "persons who, in their opinion, either have rendered conspicuous service to the cause of science, or are such that their election would be of signal benefit to the society."

The services which have been rendered to the science of botany by Dr. George Claridge Druce, of Oxford, were honored on May 23, his eightieth birthday, when he was presented by Lord Grey of Fallodon, on behalf of the Botanical Exchange Club and Society of Great Britain, with a check. With this gift Dr. Druce intends to acquire a plot of land, which will be handed over later to the Society for the Preservation of Nature Reserves or to the National Trust for the special purpose of preserving a plant that is now rare in the British Isles. The ceremony of presentation took place at a reception which was given to Dr. Druce in the Great Central Hotel in presence of a large company. Sir Maurice Abbot-Anderson was in the chair. Messages were received from universities and botanical gardens at Paris, Geneva, Copenhagen, Bergen, Brussels, Vienna, Harvard and New York, and from many English societies, including the Royal Horticultural Society and the Gilbert White Fellowship. Dr. Druce was the guest at a luncheon given in his honor by Lord and Lady Buxton at which the speakers included the chancellor of the University of Oxford and Lord Grey.

Dr. Howard E. Simpson, of the State University of North Dakota, was elected to succeed Professor Robert M. Dolve, of the State Agricultural College, as president of the North Dakota Academy of Science at the recent annual meeting held in Fargo. Dr. G. A. Abbott, of the State University, was re-elected secretary, a position in which he has continuously served for several years.

Mr. James D. Sisler, associate state geologist of Pennsylvania, has been elected state geologist of West Virginia, and will assume his work at Morgantown, West Virginia, on July 1.

Dr. Helen Thompson Woolley, professor of education and director of the Child Development Institute of Teachers College, Columbia University, has presented her resignation to take effect on September 1.

At Yale University, Dr. Mark A. May has been appointed director of the statistical bureau of the

Institute of Human Relations. Professor Walter R. Miles and Dr. Catherine Cox Miles, of Stanford University, have been appointed research associates in psychiatry and psychology. Both have been assigned to the Graduate School, the School of Medicine and the Institute of Human Relations.

DR. SAMUEL T. ORTON has been appointed professor of neurology and neuropathology at the College of Physicians and Surgeons of Columbia University and Dr. Henry A. Riley has been appointed professor of neurology and neuro-anatomy.

DR. DAVID MCCLELLAN DE FOREST, assistant professor of zoology at the University of Tennessee, has been appointed to the faculty of the American University at Beirut, Syria, as adjunct professor in zoology, for the academic year 1930–31.

DR. W. T. THOM, JR., of Princeton University, has resigned from the U. S. Geological Survey, and will divide the summer between university research and field studies contributing to a research project sponsored by the American Association of Petroleum Geologists. This latter project deals with the regional structure of the Dakota sandstone in the Northern Great Plains and Foothills regions, and is being pursued because of the light it may shed upon the causes and results of mountain building.

MR. J. M. F. DRUMMOND, regius professor of botany in the University of Glasgow, has accepted an offer of appointment as Harrison professor of botany and director of the botanical laboratories in the University of Manchester.

MR. J. S. L. GILMOUR, of Clare College, has been appointed curator of the herbarium and botanical museum of the University of Cambridge for five years.

M. G. FAYET, director of the observatory at Nice, has been appointed membre titulaire of the Bureau des Longitudes in succession to the late M. Andoyer.

PROFESSOR KARL JOHANN FREUDENBERG, of the University of Heidelberg, has been appointed Carl Schurz Memorial Professor at the University of Wisconsin for the second semester of the coming school year, beginning on February 9, 1931. Professor Freudenberg's chief researches have been along the lines of the chemistry of the tannins; lignins and cellulose; sugars; insulin, and stereochemistry. He will give two series of lectures on selected topics in advanced organic chemistry and will take a few well advanced students for research. Such students should have had previous experience in research in organic chemistry. Applications for permission to do such work should be addressed to Professor J. H. Mathews, chairman of the department of chemistry. The lectures will be open to students who have had a full year's course in organic chemistry.

DR. WILLIAM MORRIS DAVIS, professor emeritus of physiography at Harvard University, is leaving Tucson, Arizona, and will spend the summer at the University of Oregon.

DR. A. C. LAWSON, professor of mineralogy and geology and dean of the college of mining at the University of California, has gone to Europe to attend the Walther celebration and in the interest of the program of the International Geological Congress in 1932. He is chairman of the program committee.

DR. ARTHUR KEITH, chairman of the division of geology and geography of the National Research Council, has sailed for Europe to attend the centennial of the French Geological Society.

DR. WILFRED H. OSGOOD, curator of zoology at Field Museum of Natural History, has returned from London where he has been engaged in research at the British Museum in connection with specimens of rare animals obtained by the recent William V. Kelley-Roosevelts Expedition to Eastern Asia for Field Museum.

DR. F. M. HAYES, professor of veterinary science in the University of California, will spend several months in Europe, with the object of studying, chiefly at the University of Giessen, bovine tuberculosis and Bangs disease. Dr. Hayes will attend the International Veterinary Congress in London during August, and later hopes to be present at the International Institute of Tuberculosis in Oslo, Norway.

PROFESSOR HOMER W. SMITH, of University and Bellevue Medical College, is on leave of absence as Fellow of the John Simon Guggenheim Memorial Foundation to visit Siam, Sumatra and Borneo, where he plans to study kidney function, the composition of the body fluids and allied biochemical problems in fresh-water elasmobranchs and terrestrial fishes.

DR. HANS BECKER, lecturer in geology in the University of Leipzig, is working at the University of Wisconsin on sedimentation under Professor W. H. Twenhofel, of the department of geology.

DR. JOHN C. MERRIAM, president of the Carnegie Institution, gave the commencement address at New York University on June 11.

AT the convocation exercises of the graduate school of Brown University on June 14, Dr. Edwin Grant Conklin, of Princeton University, Henry Fairfield Osborn professor of biology at Princeton University, will be the speaker. The title of his address will be "Science and the Future of Man."

PROFESSOR F. K. RICHTMYER, of Cornell University, gave the address at the initiation meeting of the Society of Sigma Xi at Ohio State University on May 15. He also spoke before the physics seminar on "Secondary X-ray Spectra."

PROFESSOR CARL J. DRAKE, of the Iowa State College, Ames, lectured on "The European Corn Borer" in Davenport on May 16, the lecture being given by the Davenport Public Museum with the cooperation of the agricultural agents of ten surrounding counties in Iowa and Illinois.

DR. W. E. CASTLE, of the Bussey Institution, Harvard University, gave an address on May 21 on "The Significance of Sexuality in Organisms" before the Brown University Chapter of Sigma Xi at Providence.

DR. A. C. LANE, Pearson professor of geology and mineralogy, emeritus, at Tufts College, spoke on "The Age of the Earth" through the National Broadcasting Unit at 245 E Street, Washington, D. C., for Science Service on June 6. He has been consultant in science for the Library of Congress for this semester.

DONATIONS from the Rockefeller Foundation totaling $887,500 to Johns Hopkins University for the increased support of the biological sciences, and $100,000 for "a fluid research in the humanities," have been announced by President Joseph S. Ames. For the biological sciences $387,500 will be given over a period of ten years and $500,000 at the end of this period. The money for research in the humanities is to be given over a period of five years. The work in biology to be supported is being done by the following: Dr. Raymond Pearl, who has been director of the Institute of Biology, which has been financed over a five-year period ending this year. He will become professor of biology in the School of Hygiene and Public Health at the beginning of the next scholastic year. Dr. H. S. Jennings, Henry Walters professor of zoology and director of the laboratory; Dr. Duncan S. Johnson, professor of botany and director of the laboratory, and Dr. Burton E. Livingston, professor of plant physiology and director of the laboratory.

MR. JOHN D. ROCKEFELLER, JR., has offered to the city of New York a sixty-acre tract in Washington Heights, in northern Manhattan, for a public park, and has offered to spend about $5,000,000 to make the tract, valued at $7,000,000, suitable for public purposes. Mr. Rockefeller tendered the $12,000,000 gift in a letter to Mayor Walker, who characterized it as "a very gracious offer."

MR. JOHN D. ROCKEFELLER, JR., has contributed $200,000 toward the cost of a building for botany at the Botanical Gardens and Natural History Museum, Paris, where it is planned to establish an International Botanical Institute. The French Government has also promised to contribute $200,000 and subscriptions are being sought to the amount of $320,000.

YALE UNIVERSITY will eventually inherit more than $200,000 of the estate of Edward Anthony Bradford, editorial writer of *The New York Times,* who died in 1928.

FROM the profits from the sale of German dyes turned over to the United States by the Reparations Committee in 1920, Princeton University, Massachusetts Institute of Technology and the Philadelphia Textile School have received a total amount of over $400,000 to be used for scientific research divided as follows: Princeton University, $124,233; Massachusetts Institute of Technology, $28,057, and the Philadelphia Textile School, $248,507.

FORTY-THREE engineers and industrial executives, headed by Professor Robert Sibley, of the department of mechanical engineering of the University of California, sailed on June 3 to attend the second International Power Conference in Berlin to be held from June 16 to 25. The conference, which has been called by the German Government, will be attended by representatives of forty-seven nations. It is the outgrowth of a similar meeting held in London six years ago. A special effort is to be made at this year's conference to start a movement to regulate and standardize legal problems arising from international use of power resources.

ON May 9 and 10 the Nebraska Academy of Sciences held its fortieth annual meeting at Peru, Nebraska, State Teachers College, jointly with the Nebraska section of the Mathematics Association of America and the Nebraska Council of Geography Teachers. Lectures on the general program of the academy included: "Fossil Flora and Fauna of Nebraska," by Dr. E. H. Barbour, of the University of Nebraska; "The Use of Physical and Physico-Chemical Measurements in the Sciences," by Dr. F. E. E. Germann, of the University of Colorado; "Our Solar System and how we got it," by Dr. D. W. Morehouse, president of Drake University, and "Biological Aspects of Rocky Mountain National Park," by Dr. R. J. Pool, of the University of Nebraska. The outgoing president of the Nebraska Academy is Dr. A. E. Holch, professor of botany in the Nebraska State Teachers College, Peru. The newly elected officers are Dr. H. H. Marvin, of the University of Nebraska, *president;* Dr. H. von W. Schulte, of Omaha, *vice-president;* Professor M. P. Brunig, of the University of Nebraska, *secretary,* and Professor P. K. Slaymaker, of the University of Nebraska, *treasurer.* The meeting of the Nebraska Academy

in 1931 will be held in Lincoln and the 1932 meeting in Omaha.

THE New York State Geological Association held its sixth annual field meet at Union College, Schenectady, N. Y., on May 16 and 17, under the presidency of Professor Edward S. C. Smith. The first day was spent north of Schenectady near Saratoga and Schuylerville. The Precambrian, Cambrian and Ordovician rocks were studied. The Cryptozoon ledge, diabase dike cutting Grenville sediments, the overthrust at Bald Mountain and Stark's knob at Schuylerville were of special interest. That evening at the Mohawk Golf Club, President Day and Professor Emeritus Stoller, of Union College, addressed the geologists. Professor Stoller spoke of the Pleistocene and Post-Pleistocene drainage changes in the immediate region. On Saturday, the Helderberg escarpment and the Schoharie district were visited, a region of particular interest to paleontologists. Fossils were collected from the Devonian and Silurian outcrops. In the evening the members of the New York State Museum were hosts to the geologists in the museum in Albany. Two hundred students and their instructors, representing twenty-four educational institutions, attended the field meet. Next year the association plans to meet in the Mineville-Port Henry district of the Eastern Adirondacks. Professor Harry N. Eaton, of Elmira College, was elected president, and Professor O. D. von Engeln, of Cornell University, secretary.

THE annual field excursion of the section of geology of the Ohio Academy of Science was conducted in eastern Ohio on May 30, 31 and June 1. Special attention was given to the physiographic features of Guernsey, Belmont, Monroe and Noble Counties. Studies were also made of the stratigraphy of the Pennsylvanian and Permian systems, and the structure of the Cambridge anticline and the Parkersburg-Lorraine syncline. Fifty-seven people participated in the excursion, which was conducted by Wilber Stout, state geologist, and Paris B. Stockdale, vice-president of the section of geology of the Ohio Academy of Science.

DISCUSSION

RACE MIXTURE AND PHYSICAL DISHARMONIES

PROFESSOR H. S. JENNINGS in his recent book on "The Biological Basis of Human Nature" devotes a chapter to the subject of race mixture and its consequences. Considering first the purely physical results, he mentions both advantages and disadvantages resulting from wide racial crosses. As an advantage he reckons hybrid vigor and the covering up in the immediate offspring of any recessive defects which may be present in either parent race. As a disadvantage he mentions possible disharmony in details of structure. It is to this latter point that I wish to give brief consideration, as it is a matter of considerable biological importance apart from its human interest. Jennings says, on page 280:

> Working probably to the disadvantage of some race mixtures in man is the fact that certain human races differ in such ways that union of their characteristics may yield combinations that are in details inharmonious. In the mixture of races found in the United States, as Davenport[1] has pointed out, some of the stocks differ greatly in physique from others. Some are smaller, having organs that go with a small body—small heart, small kidneys, small jaws, small teeth; such on the whole are the races that come from the Mediterranean region of Europe. Others have large bodies, with large kidneys, heart, jaws, teeth, and other organs.
>
> Judging from what occurs in other organisms, when such diverse races are crossed, the offspring, receiving genes from both sides, may well develop combinations of parts that lack complete harmony. If a large body is combined with small kidneys, the latter may be insufficient for the needs of the individual. Or a large body might be combined with a small heart that would not keep the blood properly circulated. Large teeth, resulting from the genes of one parent, may be crowded in a small jaw that results from the genes of the other parent. In consequence the teeth decay. Partly to it, Davenport (by whom the examples given above are suggested) ascribes the prevalence of defective teeth in the United States. According to him, crowded and defective teeth are less common in nations with races less mixed.

It is difficult to measure with certainty lack of harmony between body size and size of kidney or heart, so that direct proof that the possible inharmonious combinations mentioned above actually occur in man as a result of mixture of races is not available. But the occurrence of inharmonious combinations of certain bodily parts as a result of race crossing has been observed both in man and in other organisms. A striking case of this kind in the dog—comic rather than tragic in its consequences—is described by Lang.[2] A great St. Bernard dog was crossed with a dachshund. Some of the progeny had the large heavy body of the St. Bernard, resting on the short crooked legs of the dachshund. The result (figure 49) was neither beautiful nor efficient.

The occurrence of inharmonious combinations, in human race crosses, has been shown with respect to parts of the body that are measurable, in the recent study

[1] C. B. Davenport, "The Effects of Race Intermingling," *Proc. Am. Phil. Soc.*, 56: 364–368, 1917.

[2] A. Lang, "Experimentelle Vererbungslehre," Vol. I, p. 727, 1914.

made by Davenport and Steggerda[3] on the whites and blacks in Jamaica, and on the browns resulting from crosses between them. The whites have relatively short legs and long bodies, while the blacks have relatively long legs and short bodies. "Some of the mulattoes have an unexpected combination of long legs and long body and others of short legs and short body" (Davenport). Again, in the blacks, arms and legs are both long; in the whites, both are shorter. Some of the crosses have "the long legs of the Negro and the short arms of the white which would put them at a disadvantage in picking up things from the ground."

Since inharmonious combinations of physical characteristics that are thus open to precise study are shown to occur as a result of race crossing, it appears probable that similarly inharmonious combinations of a more serious character may likewise occur, giving rise to insufficiency of heart or kidneys, or to crowding of teeth, as suggested in a former paragraph.

(1) As to the large-sized dog with short crooked legs and of St. Bernard-dachshund ancestry, what is the evidence that its lack of beauty and efficiency is a consequence of race mixture? Is not the dachshund equally lacking in beauty and efficiency? The crossbred has inherited the same dominant achondroplastic gene which is possessed by all dachshunds. There is no more disharmony in the progeny than in the dachshund ancestors. The dachshund breed is itself a race of hereditary defectives.

Suppose that a white man who was affected with Huntington's chorea should marry a Negro woman and half their children should prove to be choreic (as in all probability they would), could we ascribe this unfortunate occurrence to race mixture? By no means, the same result would have followed had the wife been a white woman.

(2) As to the supposed occurrence of disproportionally small kidneys and hearts in crosses between races of southern and northern Europe, there is more than room for doubt; there is a complete *vacuum* of evidence. I would invite any anatomist who has studied the size and efficiency of human kidneys and hearts to produce evidence that the size of these organs in relation to general body size is more variable in crossbreds or less closely correlated with general size than in either pure Nordics or pure Mediterraneans (if he can find such). The fallacy involved in this case is one which Jennings in other parts of his book has pointed out, that of supposing the anatomical parts of the body to be unit-characters and so independent of each other in their inheritance. In his zeal to avoid the fallacy Jennings condemns the term unit-character altogether, yet is himself guilty of endorsing the idea that a small kidney or small heart as such might be inherited from a small ancestor, and a large body to contain them from a large ancestor. Any one who has studied size inheritance in a mammal would know that nothing of the sort can be detected in size crosses much more extreme than any possible in the human species. For example, in rabbits races have been crossed, one of which had four times the average weight of the other. Each of these races was quite uniform in weight, more so probably than any human race. The crossbreds were with equal uniformity of an intermediate size, and in the second crossbred generation (F_2) no excessive variability was found or the slightest evidence of disharmonies, though an express search was made for them in a careful study of the correlation between skeletal parts among themselves and in relation to total body weight. It was found that when, by crossbreeding, races of intermediate size are produced, all parts of the skeleton are also intermediate and suited to each other, all being developed under a common influence, the fundamental rate of growth, which is the master controller of all general ontogenetic processes from early cleavage stages on.[4]

(3) As to the reputed occurrence of inharmonious combinations between parts of the body that are measurable, in the recent study made by Davenport and Steggerda of whites, blacks and browns in Jamaica, let us appeal from the generalizations to the detailed evidence presented by these authors in their final report. In over a hundred photographs of individuals in varied attire we look in vain for indications of one having "the long legs of the Negro and the short arms of the white, which would put them at a disadvantage in picking up things from the ground." I should greatly like to see such a picture or any other sort of evidence that a mulatto was at a physical disadvantage in picking up things because his arms were too short and his legs too long. Yet Davenport and Steggerda say in their summary of conclusions (p. 473) "The leg of the blacks is much longer than that of the whites." Turning to the detailed measurements on which this conclusion is ostensibly based (p. 119), we find the following statistics concerning leg length (in cm) in adult male blacks, browns and whites.

	Blacks (53)	Browns (91)	Whites (48)
Mean and P. E.	92.5 ± 0.4	92.3 ± .03	92.0 ± 0.4
σ and P. E.	4.8 ± 0.3	4.8 ± 0.2	4.2 ± 0.3
C. V.	5.2 p. c.	5.2 p. c.	4.6 p. c.

The reputed "much longer" leg length of the blacks turns out to be on the average longer by five tenths

[3] C. B. Davenport and M. Steggerda, "Race Crossing in Jamaica," Pub. No. 395, Carnegie Institution of Washington, 516 pp., 1929.

[4] Castle, *Jour. Exp. Zool.*, 1929.

of a centimeter! The leg length of browns is strictly intermediate between that of blacks and whites and not more variable, since the standard deviation (σ) and coefficient of variability (C. V.) are exactly the same for blacks as for browns. Surely a leg longer by three tenths of a centimeter would not be a serious physical handicap to a brown in competition with a white. Actually we look in vain for the extra-long-legged brown. No single brown has longer legs than the longest-legged whites, and two browns have shorter legs than any white.

But perhaps it is leg length in relation to total stature that puts browns at a physical disadvantage in relation to whites and blacks. Let us see. On page 45 we find the following data on total height of adult males of the three groups.

	Blacks (54)	Browns (93)	Whites (50)
Mean and P. E.	170.6 $\pm$ 0.6	170.2 $\pm$ 0.5	172.7 $\pm$ 0.7
σ and P. E.	6.8 $\pm$ 0.4	6.7 $\pm$ 0.3	6.9 $\pm$ 0.5
C. V.	3.96 p. c.	3.97 p. c.	3.97 p. c.

On the average whites are two centimeters taller than blacks and browns, but the variability of all three groups is substantially the same, although that of browns is the lowest, notwithstanding the fact that it is the most numerous group, and if recombination occurs in browns of genes for tallness and shortness obtained from whites and blacks respectively, we should expect browns to be most variable. Accordingly, I am at a loss to see where either Davenport or Jennings finds justification for the idea that the brown Jamaicans have dangerously disharmonious combinations of stature and leg-length.

But according to the quotation, it is the short arms inherited by the browns from the whites which, combined with the supposed long legs derived from the blacks, put them at a disadvantage. Let us see how great the difference in arm length is. On page 88 (Davenport and Steggerda) the following statistics are given for arm length (acromion-stylion) of adult males.

	Blacks	Browns	Whites
Mean and P. E.	57.3 $\pm$ 0.3	57.9 $\pm$ 0.2	56.8 $\pm$ 0.3
σ and P. E.	3.1 $\pm$ 0.2	3.1 $\pm$ 0.1	2.9 $\pm$ 0.2
C. V.	5.5 p. c.	5.4 p. c.	5.2 p. c.

The difference in mean arm length between blacks and whites is five tenths of a centimeter, exactly the same as in mean leg length. In other words, there is evidently a very close correlation in man as in rabbits between arm length and leg length. The blacks have longer arms as well as longer legs than the whites, but the difference is very small, five tenths of a centimeter.

Now let us suppose that the worst fears of Davenport and Jennings were realized and a brown inherited "the long legs of the Negro and the short arms of the white, which would put them [him] at a disadvantage in picking things up from the ground," how much farther would he have to stoop in order to reach the ground with his finger tips? *Just one centimeter!* I do not think that an employer would find a brown so constituted at a serious disadvantage as a field hand in comparison with either blacks or whites. As a matter of fact, I very much question the independent inheritance of leg length and arm length in man. I think if the matter were studied from the records of Davenport and Steggerda (which they do not publish in a form available for this purpose) it would be found in man, as I have found in rabbits, that a close correlation exists between the dimensions of upper and lower extremities. The coefficient of correlation in rabbits was found to be for femur-humerus, 0.91; for tibia-humerus, 0.90; for femur-tibia, 0.93 (Castle, 1922).

If there were unit-character inheritance of the difference in arm length and leg length between blacks and whites, then we should expect to find browns more variable than either blacks or whites through recombination of units. This they are emphatically not, according to the statistics of Davenport and Steggerda. Hence we may dismiss as wholly unsupported by evidence as yet produced the idea that a brown *could* inherit "the long legs of the Negro and the short arms of the white." Even if he did, it would be a matter of no consequence, as Jennings would doubtless admit. He cites it merely as an indication that "similarly inharmonious combinations of a more serious character may likewise occur, giving rise to insufficiency of heart or kidneys." Since the evidence of the assumed independent inheritance of arm and leg length is wholly lacking, the case is valueless to support an apprehension itself without other support and almost incapable of verification.

We like to think of the Negro as an inferior. We like to think of Negro-white crosses as a degradation of the white race. We look for evidence in support of the idea and try to persuade ourselves that we have found it even when the resemblance is very slight. The honestly made records of Davenport and Steggerda tell a very different story about hybrid Jamaicans from that which Davenport and Jennings tell about them in broad sweeping statements. The former will never reach the ears of eugenics propagandists and Congressional committees; the latter

will be with us as the bogey men of pure-race enthusiasts for the next hundred years.

W. E. Castle

Bussey Institution,
Harvard University

THE PLANT QUARANTINES ONCE MORE

The article by Professor E. O. Essig in a recent number of Science[1] presents a fair statement of the point of view of those who support the program of federal and state plant quarantines which has reached its most conspicuous phase in connection with the invasion of Florida by the Mediterranean fruit-fly. And as such a statement it reveals clearly the weaknesses in the arguments of the supporters of these measures. The most pronounced of those weaknesses is the refusal of these supporters to face squarely certain disagreeable facts.

Professor Essig sums up the value of the fruit industry in the area where the fruit-fly might live and contrasts its annual crop value of an estimated $240,000,000 with the paltry sums aggregating—according to his figures—$5,250,000, which have been expended by governmental agencies in the war against the Mediterranean fruit-fly in Florida. There is in his article no intimation that this is not a full and adequate statement of the case. Nor is there any recognition of the fact that a proper accounting will charge against the quarantines and their associated measures not merely the sums of money expended by government officials in their administration but all other sums for which the quarantines are responsible.

The actual damage done by the fruit-fly in Florida through the spoiling of fruit and rendering it inedible was relatively insignificant. It was so small that it had not impressed itself upon the consciousness of the growers. But the application of the quarantines, with their restrictions upon marketing of fruit and vegetables, brought about bank losses which have been estimated at $60,000,000. I know of no estimates of the losses suffered by growers and not included in the bank losses, but surely an estimate of $5,000,000 would not be too high. We have then, instead of about $5,000,000, at least $70,000,000 to be charged up as the cost of the "protective" measures which were undertaken. This is an amount equal to more than one fourth of the annual value of the crop which is being protected. Furthermore, it should be noted that only a part of this fruit crop is subject to infestation by the fly, for the evidence indicates clearly that many fruits will not be attacked in any significant degree. It would probably be closer to the facts to estimate that the actual costs in Florida for the first year of the campaign against the fly which are to be charged up to the restrictive and control measures alone and not to the damage done by the insect are equal—on the basis of the figures given by Professor Essig—to at least one half the value of the fruit crop for one year in the area subject to infestation. And at the present writing the fly is not yet eradicated.

The ignoring of such facts as this is accompanied by an equally obtuse refusal to face certain other facts. The monetary losses of the fruit-fly campaign have been accompanied by the development of sectional bitterness that it will take long to remove and that is perhaps as important as are the financial aspects. Such effects can not be set aside as unimportant. The effect of the quarantine measures in stirring up intersectional and interstate resentments and competition outside of the normal and legitimate range of commercial rivalry is a dangerous aspect of their results. They set up what are in effect prohibitive tariff walls among the states, walls which under our national organization are not supposed to exist. They function also as prohibitive international tariffs to which consumers have every right to object.

No reference to such effects is to be found in the rosy picture of the plant quarantines which is presented by Professor Essig. Nor is any reference there to be found to the absurdities of quarantines directed against wind-borne insects, to the absurdities of intercounty quarantines, to the inadequacy of training of personnel, to the gaps that are left open by quarantine administrators, to the cost of a service to which adequate salaries would attract adequately trained men and which would permit the actual achievement of the functions for which the quarantines are presumably established. These are things which the supporters of the quarantines may discuss in private, but in public never.

That the effectiveness of the quarantines has in some cases been greatly overrated is indicated by the following example. In the mimeographed copy of a speech delivered in December, 1929, by Mr. G. H. Hecke, state director of agriculture of California, there is contained the following statement:

> For eight years the alfalfa weevil has been halted at the California line, although it jumped from the Salt Lake Valley in Utah into the Reno-Sparks district of Nevada in twenty-four months. Unrelenting quarantine vigilance has kept it from the major alfalfa-producing districts of this state.

I have available an authoritative statement of the actual facts concerning the spread of the alfalfa weevil. According to this statement the weevil was present in Salt Lake County, Utah, before 1905. It appeared in Washoe County, Nevada—which is the

[1] Science, N. S. 71: 350–353, April 4, 1930.

Reno-Sparks district—in 1920, its establishment in this county being of probably not more than a year's duration. This is an interval of at least fifteen years, instead of the two years indicated in the statement quoted. It was first found in Sierra County, California, in 1923 and in Plumas and Lassen Counties in 1925. A reference to the map of California will indicate that the insect was halted, not at the state line by the vigilance of the quarantine officials, but at the line of the Sierras in all probability by the natural barrier of the mountains.

That the plant quarantines have certain possible protective values may freely be admitted. Just how far those values extend and how to obtain them and still avoid the dangers that have been pointed out, how to obtain them at a price that has a proper relation to that which is bought, how to serve one portion of the population without infringing upon the equally just rights of another part—these are serious problems. That they can be solved and the quarantines maintained is debatable. The arguments against the quarantines are real; the solution is not to be obtained by ignoring them. It would seem desirable for the supporters of these measures to enlarge the range of their view sufficiently to include a larger proportion of the facts of the situation.

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HAIR GROWTH AND PREGNANCY

IN studying the rate of hair growth on guinea-pigs by the method of observing the regeneration of hair on shaved areas, it was noted that in pregnant females the number of hairs which regenerate reaches a minimum at the time of delivery. This observation is of special interest since the literature records conflicting observations on hair growth during pregnancy in women; references concerning increased hair growth during this period are quite as numerous as references to a retardation of hair growth or quiescence of the follicles.

In order to test the constancy of this phenomenon, the backs of a series of guinea-pigs were shaved weekly and observed over a period of six months. The amount of regeneration was computed by counting the number of follicles in the shaved area (a two centimeter square) and noting those which were active and those which were in a resting stage. This series of animals was composed of five unmated males, five virgin females, two breeding males and ten breeding females. In view of the possibility that the condition observed might be due to the cyclic or seasonal activity of the follicle, the males and the virgin females were used to control such possible factors.

The regeneration of the hair in the shaved areas in all control animals was uniform (approximately 25 per cent. of the follicles being in an active state), whereas in all pregnant females the number of hairs regenerating was noticeably less by about the third week before delivery and continued to decrease until delivery, at which time the minimum regeneration was noted (less than 1 per cent.). After delivery the follicles remained in a quiescent state for approximately two weeks. During the third week postpartum the number of regenerating hairs slowly increased and by the end of the fourth week the rate of regeneration had apparently returned to normal.

In some of the pregnant females the hair came out in quantities, leaving areas in the region of the back and sides practically devoid of hairs. This condition occurred in varying degrees.

These observations on the guinea-pig seem to indicate that there may be a negative correlation between the regeneration of hair and pregnancy. At the present time a larger series of guinea-pigs is being observed and full details of the results of experiments now in progress will be published.

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SYMBIOTIC MITES USED TO SEPARATE SPECIES OF A GENUS OF BEES

IN recent years it has been recognized that the parasites found on various species of a group of animals may be able to throw light on problems of taxonomy and general geographical distribution. What is proving to be a very interesting correlation of host and symbiont is being worked out for a group of mites of genus *Dinogamasus* and their hosts, certain carpenter-bees at present considered as members of genus *Mesotrichia* Westwood. These carpenter-bees are mainly confined to the Ethiopian and Oriental regions and one species occurs from Egypt to the northwest provinces of India.

In the first abdominal segment of the female bees there is a peculiar chamber formed by an inflated invagination of the chitinous exoskeleton. Within this pouch, or chamber, which has no opening into the body of the bee, a few or a dozen or more of the little mites may be found.

The mites which I have collected from the African bees fall into three distinct groups and their hosts seem to belong to corresponding groups. The mites examined from the Oriental regions also seem to belong to a few distinct groups all readily distinguishable from the African forms. Usually each species of bee has its own characteristic mite regardless of a wide geographic range. In some cases very closely allied bees have the same kind of mite.

A very fine example of the value of knowing the correlation of host and symbiont was demonstrated when studying the disputed *Mesotrichia aestuans* and *M. confusa* of India. *M. aestuans* is a recognized north African form, and within its pouch there is a characteristic African mite belonging to the *braunsi* group which I have named *Dinogamasus inflatus* because of certain swollen hairs on the legs. There has been more or less uncertainty whether the *confusa* of the Orient is the same as the African *aestuans*. Pérez recognized the two forms, using the margin of the clypeus, the clypeal keel and the frontal keel as the main distinguishing features. It has been recently claimed that these species are not distinct.

It was interesting to find that two specimens of these disputed bees which I had from northern India had the African *Dinogamasus inflatus* in the pouch, and that another bee labeled from Sikkim, India (from the Bingham collection, Berlin Museum), as well as other specimens of *confusa* from other Oriental localities, had mites belonging to the Oriental group.

Dr. T. D. A. Cockerell examined the hosts and upon comparison with an African *aestuans*, taken at Suez, he found that the specimens from northern India (Chikar Kot, N. W. Prov., and Jammu, Kashmir; Frank Benton collector, National Museum specimens) are the genuine *aestuans*, thus evidently belonging to the Palearctic fauna which extends over from northern Africa. The other form of carpenter-bee he determined as the true *confusa*, and this, belonging to the Oriental region, naturally should harbor a distinctly Oriental species of mite.

Another case of the mites helping to distinguish between slightly differing hosts may be cited. Two specimens labeled *confusa*, one from Singapore and one from Trang, Siam, yielded closely related but nevertheless distinctly different species of mites. Examination of the hosts showed that the one from Trang was *M. confusa* var. *viridissima*. It is conceded now that this form should be considered a valid species *M. viridissima*.

Norma LeVeque
University of Colorado

PROFESSOR EINSTEIN'S ADDRESS AT THE UNIVERSITY OF NOTTINGHAM[1]

Professor Einstein does not wish you to accept his remarks on credit, but wishes to explain in the clearest way possible what he considers to be the trend of modern physics. What he has to say is his purely subjective opinion and it is by no means generally recognized. He thinks that he can give you at least some outline of what his view is of the future of the subject, but he does not want his remarks to be regarded as assertions. He wants them to be regarded rather as humble expressions of his opinion.

He will now concentrate our attention on the fundamental conceptions which lay at the beginnings of the foundations of physics. Professor Einstein makes clear what the prescientific view was and explains that the primitive concept was that of a rigid body and that relationships in the positions of rigid bodies preceded all ideas of space; that space was not a primary conception and that it was only through dealing with the position and relationships of bodies that the idea of space later emerged.

These ideas of space were due, of course, to contact relationships between bodies, and it is interesting to know that the classical science of the Greeks did not operate with space but exclusively with bodies. A rigid body is at the bottom of all the conceptions of geometrical space in Euclid.

The idea of a space continuum entered into science only when analytical geometry was invented by Descartes. How did the idea of space originally arise? The Greeks approached position in geometry by considering the position of bodies with regard to each other. This, of course, suggests a body of reference. We are familiar with coordinate systems in geography in the way in which they were used, for instance, in maps of geography.

Space appears expressed in body-like form by means of these axes of reference. This is really the way in which space as such entered into geography in the first place, and there was no physical basis for it. Relative motion occurs only with reference to one or more bodies. The great change took place in that view when Newton propounded his mechanics.

The fundamental idea of Newton's mechanics was the introduction of the idea of force—that is to say, acceleration. Acceleration can be imagined only in reference to a really rigid body. It is a wonderful tribute to Newton's genius that he could go so far as to give space a definite physical reality.

He included it among the other realities. This is an aspect of his theory which has not been understood or has been neglected or misunderstood by some of his followers. Professor Einstein is very anxious

[1] The address given in German on June 7 was translated by Dr. I. H. Brose. A stenographic report of Dr. Brose's translation was cabled to *The New York Times* and permission has been given for publication in Science.

that this particular point be emphasized—that space entered as a definite physical reality. It was a point which was missed even by the philosopher Kant.

A remark should be added about the physical idea of space. There are two aspects. In one of them space is to be regarded as the quintessence of positional possibilities of bodies, and, secondly, as a definite dynamic system of reference.

Professor Einstein emphasizes that Newton's space is to be regarded as absolute in the sense that positional possibilities of rigid bodies are to be considered as quite independent of outside forces, although he does not take temperature into consideration. This space is independent of all physical causes and is something which is absolute in itself.

In Professor Einstein's opinion a definite change in the view of nature after the time of Newton occurred when the idea of the electro-magnetic field was introduced by Faraday and Maxwell. The only real things at that time were bodies, space and time. Those were constructive elements from the physical viewpoint of the times. There were no others.

Faraday introduced the idea of "a field," and his contemporaries were bound to that method of introducing the idea of a state owing to the manner of thought of their time.

They, therefore, introduced a new body called the ether—or at least a new idea which they called ether—to represent a physical state. The introduction of ether was necessary in order to allow electro-magnetic phenomena to occur in space. This view received considerable strengthening at the hands of a Dutchman named Lorentz, who showed that in the electro-magnetic theory of states all ponderable bodies were those of ether and not of material bodies themselves.

Looking back now we might ask why ether as such was introduced. Why not have called it "state of ether or state of space"? The reason was they had not yet got to realize the connection or lack of connection between geometry and space, and so they felt constrained to add to space a variable brother, as it were, which could be a carrier for all electromagnetic phenomena.

The next change in the idea of space was comparatively small. It was due to a special theory of relativity sometimes called the "restrictive" theory of relativity. Classical physicists had two separate continua which were to be regarded as a performing stage for continua. Those were space and time. Altogether, they formed four dimensional continua, three being in space and one in time.

But it had to be subdivided into two blocks due to the fact that there were a before and an after and to satisfy the requirements of simultaneity. It was found, however, that to satisfy the demands of the constancy of propagation of light the subdimensions of space and time could not in this way be preserved or carried out.

The space-time phenomenon of the special theory of relativity was something absolute in itself, inasmuch as it was independent of the particular state of motions considered in that theory.

A definite change in our ideas about the rôle and constitution of space was due to the enunciation of the general theory of relativity, for which the ground had been prepared by the special theory of relativity. The law of inertia—we called it Newton's first law of motion—has shown a gap in its logic because we were not able to tell when coordinate systems were in acceleration or in rotation. We had no definite means of establishing it.

This is what is known in the general theory of relativity as "the principle of equivalents." It implies that an accelerated, coordinate system can be regarded in a certain sense as equivalent to what was known as the "inertial system." Watches and measuring rods were not found to operate in the same way for accelerated systems as for coordinate systems of the special theory of relativity.

To preserve the theory of relativity for the accelerated motions as well as for the uniform regular motions of the special theory of relativity, Euclidian geometry, having been found to be too restrictive, had to be rejected and a new geometry of space found. In order to preserve position possibilities of space we were compelled to regard them as no longer independent of positions of other bodies.

In other words, the privileged position of geometry had to be given up and the viewpoint of covariants, as it is known to mathematicians, has been gained. This means that for a description of physical phenomena we must regard all generalized coordinates as of equal validity.

What, as general theory, has relativity then actually achieved? Professor Einstein does not want to enter into the question of the three experimental tests, which have all conformed to his suspicions, but the main achievement of the general theory of relativity is that it has advanced a uniformity of view of the physical world structure. The metrics of space can be derived directly from the full equation and it reduces a number of hypotheses which were originally thought necessary to account for physical phenomena. It has built, so to speak, a bridge between geometry and physics.

The next question is—What are the weaknesses of the general theory of relativity? Taking as a basis the Rummbey-Riff structure of space, we find that geometry and gravitation were completely repre-

sented by this structure, but what was to be done with the electro-magnetic phenomena which play an exceedingly important part in the world of physics?

In order to introduce these phenomena and to take them up in the general scheme of relativity it was found necessary to add to or impose upon the metric structure or Rummbey-Riff structure further terms which could account for electro-magnetic phenomena. Logically this structure had nothing to do with that which had been deduced from the elementary law of propagation of light. This duality in the geometrical structure of space leaves us in a rather indistinct state.

Professor Einstein feels that it should be possible to get a further form of this metrical space which will at one stroke comprise all phenomena in one set of equations, so that we shall not have a double metric structure of geometry and gravitation, on the one hand, and electro-magnetics on the other.

We want a system of equations which will take in all physical phenomena. This would be an enormous gain in the picture of the uniformity of physical nature.

As to the way in which the problem may be solved Professor Einstein says that it is a very difficult question to answer, and it has not yet been finished. His colleagues regard his view as a particular craze and do not support it. Nevertheless, he has faith in the path along which he is proceeding, and although the theory is not yet quite finished, he has evidence that so far as he can judge the end is very near.

He says that there is a metrical structure of space, but that a full-time structure has yet to be determined. Then he wishes to find what conditions have to be made in the older structure or what modifications in electro-magnetic phenomena may be included. He emphasizes that he is in no way taking notice of the results of quantum calculation because he believes that by dealing with microscopic phenomena these will come out quite by themselves. Otherwise he would not support the theory.

Then he says that a new idea which has occurred to him and on which he has been working is that the two elements in space should also be compared with direction. So far we have compared them only as regards size. This idea may give a clue. It occurred to him suddenly during a severe illness two years ago that by introducing the idea of direction he would be able to get the additional terms that are required in regard to space to allow electro-magnetic phenomena to be included with those of gravitation and geometry.

Professor Einstein's object now is to get mathematical conditions which will satisfy all his expressions and will comprise electro-magnetic equations as well. The problem is nearly solved, and to the first approximations he gets laws of gravitation and electro-magnetics. He does not, however, regard this as sufficient, though those laws may come out. He still wants to have motions of ordinary particles come out quite naturally.

This does not finish the program by a long way. It has been solved for what he calls "quasi-statical motions," but he also wants to derive elements of matter (electrons and protons) out of the metric structure of space. No doubt much work will have to be done before this is achieved. Professor Einstein thinks, however, that the way in which he has sketched the evolution of physical ideas is the only possible one—at least to him.

The strange conclusion to which we have come is this—that now it appears that space will have to be regarded as a primary thing and that matter is derived from it, so to speak, as a secondary result. Space is now turning around and eating up matter. We have always regarded matter as a primary thing and space as a secondary result. Space is now having its revenge, so to speak, and is eating up matter. But that is still a pious wish.

THE IOWA ACADEMY OF SCIENCE

THE forty-fourth annual meeting of the Iowa Academy of Science was held at Iowa State College at Ames on May 2 and 3, with 330 members and visitors in registered attendance.

The president's address, "The Ether Concept in Modern Physics," was given by Professor L. B. Spinney. The academy address, "Methods of Space Determination," was presented by Dr. C. C. Crump, professor of astronomy at the University of Minnesota. Professor Crump took the place of Dr. R. A. Gortner, of the University of Minnesota, who was detained on account of the serious illness of his son. Dr. Crump also acted as the American Association representative at this meeting. Other papers of the general meeting were: "A Statistical Test of Experimental Technique," G. W. Snedecor; "X-ray Diffraction in Water 2° to 98° C.: The Nature of Molecular Association," G. W. Stewart; "A Note on the Transneptunian Planet," D. W. Morehouse; "Some Recent Modifications of the Geological Map of Iowa," A. O. Thomas, and "Soil Bacteriology as a Science," P. E. Brown.

Grants from the academy research fund[1] were made

[1] The academy research fund is made possible by the refund of the American Association for the Advancement

to Professor Ben H. Peterson, of the department of chemistry, Coe College, for the purchase of special equipment for use in the study of the adsorption and coagulation of colloidal suspension by electrolytes, and to Professor L. D. Weld, of the department of physics of Coe College, for assistance in computations in an analysis of cosmic-ray observations.

Dr. R. E. Buchanan, dean of the Graduate School; Mr. R. I. Cratty, curator of the herbarium, and Dr. W. E. Loomis, associate professor of plant physiology, all of Iowa State College, were appointed delegates to represent the academy at the Fifth International Botanical Congress to be held at Cambridge, England.

Officers and section chairmen for the year 1930–31 were elected as follows:

President, H. L. Rietz, Iowa City; *vice-president,* J. H. Lees, Des Moines; *treasurer,* A. O. Thomas, Iowa City; *editor,* G. H. Coleman, Iowa City; *secretary,* J. C. Gilman, Ames; *press secretary,* F. J. Lazell, Iowa City; *A. A. A. S. representative,* H. W. Norris, Grinnell.

Bacteriology, B. W. Hammer, Ames; *botany,* E. W. Lindstrom, Ames; *chemistry, inorganic and physical,* R. M. McKenzie, Fairfield; *chemistry, organic and biological,* L. C. Raiford, Iowa City; *geology,* L. W. Wood, Ames; *mathematics,* G. W. Snedecor, Ames; *physics,* A. Ellett, Iowa City; *psychology,* E. O. Finkenbinder, Cedar Falls; *zoology,* H. E. Jaques, *Mt. Pleasant.*

BACTERIOLOGY SECTION
(*R. H. Walker*)

Twenty-one papers, representing many phases of bacteriology, were presented at the meeting of the bacteriology section. Among the papers dealing with general bacteriology were: "Factors Influencing the Production of Acetic Acid from Corn Stalks by Thermophilic Bacteria," by C. H. Werkman and R. H. Carter; "Further Observations on Bacteria Digesting Agar," by H. E. Goresline; "Some Notes on the Purification of Packing House Wastes," by Max Levine; "Bacteriological Studies of Freshly Broken and Frozen Eggs," by D. Q. Anderson; "Dimethyl-alpha-naphthylamine for the Determination of Bacterial Reduction of Nitrates," by C. H. Werkman, and "Some Bacteriological Problems to be Considered at the International Botanical Congress, at Cambridge, England, 1930," by R. E. Buchanan. The papers dealing with veterinary bacteriology were: "Notes on the Bacterial Flora of the Snake," by Roger Patrick and C. H. Werkman; "The Effect of the Brucella Group of Micro-organisms on Chickens," by S. H. McNutt and Paul Purwin; "The Hemoglobin Content of the Blood of Wild Fowls," by H. H. Dukes, L. H. Schwarte and F. D. Patterson, and "Coccidiosis in Swine," by Charles Murray and H. E. Biester. The papers dealing with soil and dairy bacteriology were: "Soil Bacteriology as a Science," by P. E. Brown; "Further Studies on the Nitrate Assimilating Power of Soils," by Ray A. Pendleton and F. B. Smith; "Effect of Artificial Manures on Nitrification in Carrington Loam," by F. B. Smith; "Effects of Calcium and Magnesium Limestones on the Bacteriological Properties of Grundy Silt Loam," by Arthur W. Young; "Phosphate Assimilation by *Ozotobacter chroococcum,*" by L. G. Thompson; "Studies on Nitrogen Fixation by *Rhizobium meliloti* and *Rhizobium japonicum,*" by G. Gordon Pohlman; "Spontaneous Culture Studies of the Non-symbiotic Nitrogen Fixing Bacteria in the Grundy Silt Loam," by John L. Sullivan; "Studies on Nitrogen Fixation in Some Iowa Soils," by R. H. Walker; "Preliminary Observations on the Escherichia-aerobacter group of Bacteria with Reference to Dairy Products," by M. W. Yale, and "Observations on an Unusual Contamination in Butter Cultures," by M. P. Baker.

of Science. This refund is granted the academy for the members of the academy who are also members of the association.

BOTANY SECTION
(*M. Rae Johns*)

The botany program was made up of thirty-two papers dealing with plants and plant problems in Iowa. Much interest was shown in C. W. Lantz's discussion of the status of biological sciences in the high schools of Iowa. Other outstanding papers were B. Shimek's discussion on chaparral and savanna in Iowa, R. P. Adams's presentation of some rare Iowa grasses and G. W. Wilson's report on some noteworthy Iowa fungi. New mosses were added to Iowa's list in papers read by Lucy Cavanagh and Betty Blagg. A. R. Stanley reported on Cladonias of Iowa; M. Rae Johns presented the second of a series of papers on Heliantheae of Iowa. In his paper, W. H. Loehwing gave the results of experiments showing the effect of light intensity on tissue fluids in wheat. J. N. Martin discussed crowns and roots of annual and biennial white sweet clover, and also polyembryony in alfalfa and clover. Miss Florence Smith presented a paper on the identification of *Symphoricarpos occidentalis.* A. L. Hershey reported on weeds of alfalfa fields in Iowa, and also discussed the development of the vascular system of corn.

There were other papers of equal interest. The session closed with an illustrated talk by L. H. Pammel on the botany of Cuba, and weeds between Cuba and Iowa. Dr. B. Shimek was the recipient of congratulations for having completed his fortieth year of membership in the academy, and also for his valued services in the interest of conservation in Iowa.

Chemistry Section

general and physical

(*Ben H. Peterson*)

Twenty-five papers were presented before the two divisions of the chemistry section. Separate sessions were held Friday afternoon, and on Saturday morning selected papers were presented to both divisions. President Hughes, of Iowa State College, was the guest of honor at the section dinner.

organic and biological

(*J. B. Culbertson*)

The organic and biological chemistry section began its meetings with a large attendance. Twelve papers were presented, two of which were given before a brief joint meeting with the inorganic and physical chemistry section on Saturday morning. There was a good distribution of papers from the state schools and colleges of Iowa. The papers presented represented researches which had been carried on in the various schools during the past year. Professor L. Charles Raiford, of the State University, was elected chairman of the section for the ensuing year.

Geology Section

(*C. S. Gwynne*)

For the geology section, the paper of most general interest was that by A. O. Thomas, in which the newest ideas with regard to the geological map of Iowa were outlined. Papers dealing with the Chemung of New York and a possible Chemung of Iowa were presented by Lowell R. Laudon, H. D. Curry and A. C. Testor. James H. Lees described the section at the Clarinda oil prospect and compared it with other sections across the state. The road materials from the Des Moines series of south-central Iowa were described by L. W. Wood, and data on maximum precipitation in short periods of time were presented by Charles D. Reed. The faunal facies of the Fort Riley limestone was described by Donald B. Gould. Other papers were presented by title.

Mathematics Section

(*John F. Reilly, Secretary*)

The nineteenth regular meeting of the Iowa Section of the Mathematical Association of America was held in conjunction with the forty-fourth meeting of the Iowa Academy of Science. A program of eighteen papers was presented, including both pure and applied mathematics. In addition the retiring chairman, Professor E. W. Chittenden, gave an address on "General Topology." Officers for the coming year were elected as follows: *Chairman,* G. W. Snedecor, Iowa State College; *vice-chairman,* E. C. Ingalls, Iowa Wesleyan College; *secretary,* J. F. Reilly, University of Iowa.

Physics Section

(*E. Hobart Collins*)

The physics section held two meetings at which thirty-one papers covering a wide range of topics were presented. A selected group of papers includes three papers by Thos. C. Poulter and students on the effect of high pressure on the index of refraction of paraffin, oil and glass, studies of zinc fluorescent screen under pressure and recent developments in high pressure windows. There were four papers concerning the improvement of research and teaching apparatus and equipment. William Kunerth presented two papers on skyshine and sunshine at Ames, Iowa, and minimum lighting intensities required for reading. Students of A. Ellett presented two papers on optically excited cadmium spectrum and reflection of zinc atoms from NaCl crystals.

Psychology Section

(*W. E. Slaght*)

The attendance at the recent meeting of the psychological section of the academy was the largest since its reorganization some five years ago. In all, nineteen papers were presented. Five were in the field of educational psychology, six in experimental and two in applied psychology. Three papers dealt with problems of child study. A very interesting presentation dealing with the abnormal was a study of "The Relationship between Recent Impressions, and Factors Occurring in Dreams Induced by Them," by William Malamud. At the dinner of the psychological section an able address was given by C. A. Ruckmick on "Present Trends in Psychology." Those attending the section meetings were delightfully entertained by the members of the psychological staff of Iowa State College.

Zoology Section

(*J. E. Guthrie*)

The zoological program ranged from the protozoan rôle in ruminant stomachs by E. R. Becker and R. E. Everett, who find that they seem neither markedly harmful nor useful to their hosts; to the bison in Iowa by L. H. Pammel, who records its presence in the fifties, and its former abundance. Text-books have long taught error regarding the shark's ear, as H. W. Norris showed. The goldfish development of ovary and oviduct was beautifully illustrated and described by Frank A. Stromsten. R. G. Anderson reported interesting studies of rates of regeneration in mutilated *Daphnia magna.* The little-known insects known as springtails are shown by H. B. Mills to have some economic importance, both positive and negative. Another white grub distribution paper by H. E. Jaques showed records for 1929. Two studies

of winter bird records in Iowa by T. C. Stephens and William Youngworth showed a larger winter list than expected. Walter W. Bennett emphasized what should be studied and recorded about birds in Iowa now. George O. Hendrickson's "Teaching of Biology in Iowa Schools" awakened keen discussion.

JOSEPH C. GILMAN,
Secretary

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN APPARATUS FOR THE PREPARATION OF SMALL ORGANISMS

THE apparatus herein described permits the preparation of micro-organisms and small whole mounts in such a manner that (1) the change in concentration of a reagent and from one reagent to another is gradual, (2) the organisms remain on the same cover glass without the application of an adhesive agent from the time they are killed until the process of mounting is completed and (3) the objects may be viewed under the microscope during any stage of the process.

DESCRIPTION

A block of wood (Fig. 1) supports three vertical cylindrical rods each ½ in. in diameter and 20 cm

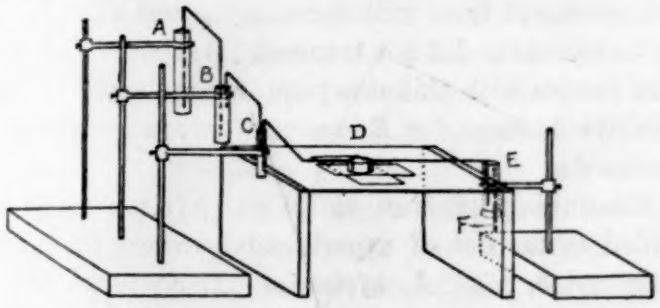

FIG. 1

long. An arm 11 cm long extends horizontally from each rod. One end of the arm bears a spring clamp for the securing of a small shell vial, the other is fitted with a collar and set screw permitting easy adjustment of its position on the vertical rod. The three shell vials *A, B, C,* of a size appropriate to the demands of the technique used, are connected by small capillary tubes. From vial *C* a capillary leads into the chamber *D* containing the organisms. The glass capillary which serves as an outlet from this chamber leads into the constant level device at *E*. The latter consists of a glass cylinder 1.5 cm in diameter and 5 cm long. At the bottom is a cork through which is inserted the capillary shown at *F* which is somewhat greater in diameter than that of the outlet capillary from *D*. The height of the top of the capillary *F* is equal to the fluid height desired in the chamber. The chamber *D* is elevated on a glass-topped table, the dimensions of the latter being adequate to permit the insertion of a microscope stage so that the preparation may be within the field of the objective.

THE REAGENT CHAMBER

This part of the apparatus (Fig. 1, *D* and Fig. 2) consists of a clamp formed of two brass plates 4 cm

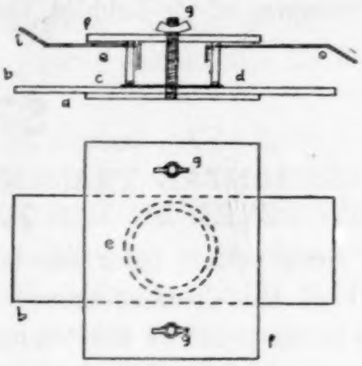

FIG. 2

by 5 cm, each of which is drilled through the center with a circular hole 21 mm in diameter. Two pillars, shown at *g*, fashioned from No. 8–32 by ⅜ in. brass machine screws are set 3.5 cm apart on the median long axis of the lower plate *a*, and corresponding holes at *g* are drilled in the upper plate so that it may be slipped over the pillars and clamped by wing nuts. A 1 in. by 3 in. glass slide *b* is placed on the bottom plate between the pillars; at *c* is a 22 mm square cover glass over which lies a thin circular cork washer *d* with internal and external diameters of 20.5 mm and 22 mm respectively. Upon this washer is placed a glass cylinder *e* 8 mm high, the circular dimensions being the same as those of the cork washer. The upper and lower surfaces of the cylinder are ground in order that the faces may be smooth and parallel. At opposite ends of a diameter, on the upper surface of the cylinder, areas are filed away sufficiently large enough to permit the intake *i* and outlet *o* capillaries to enter the chamber without extending above its surface. The intake and outlet capillaries are sealed to the chamber at their points of entrance with dental cement. The chamber is made fluid tight by adjusting the upper brass plate over the cylinder and firmly and evenly clamping it by means of the wing nuts at *g*.

METHOD OF OPERATION

The organisms are introduced into the chamber and the killing agent applied with a pipette. The reagent to follow is placed in vials *A, B, C* (Fig. 1). From then on, changes in reagents or concentrations are made in vial *A*. Vial *B* is a preliminary mixing chamber, and vial *C*, usually much smaller than the

other two, completes the solution or equalization of the reagents.

After the final process of clearing is complete, the excess reagent is removed from the chamber by a pipette, the clamp is released and the cover glass inverted over a drop of balsam placed on a slide.

Corks with holes for the entrance of the capillaries may be placed in the vials to prevent evaporation, also a large cover glass should be placed over the chamber when the process is not being observed under the microscope. If a capillary fails to function because of the presence of air bubbles, the intake capillary of the vial from which it leads is removed. Then, a mouth pipette is inserted through its place in the cork and an air pressure exerted sufficient to cause the resumption of flow through the capillary.

The flow into the chamber containing the specimens is so gradual and the mixture of the reagents entering it has been found to be so complete that small protozoa will remain stationary on the cover glass and not be carried by convection or solution currents into the drain leading from the chamber.

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SPECIAL ARTICLES

THE EXPERIMENTAL TRANSMISSION OF YELLOW FEVER BY MOSQUITOES[1]

FOR many years yellow fever has been one of the most dreaded of the diseases menacing the human race in the warmer parts of the western hemisphere. The rapid conquest of its frontiers has been one of the great achievements of modern warfare on disease.

Ever since the memorable work of the American Commission (Walter Reed *et al.*) established *Aedes aegypti* as an essential host in the yellow fever cycle, epidemiological studies and palliative measures have revolved about the domestic relationships of this so-called yellow fever mosquito.

In addition to experiments with this species, the Americans[2] in Cuba and the French Commission[3] in Brazil, using human volunteers, attempted the passage of yellow fever through *Culex quinquefasciatus* (=*fatigans*), an important human pest widely distributed in the tropics. The French Commission also undertook transmission experiments with *Aedes scapularis, A. taeniorhynchus, Psorophora ciliata* and *P. posticata*. None of these experiments were successful.

More than two decades later, in West Africa, Bauer[4] carried out the first successful transmission experiments with species other than *A. aegypti*. The belief that the dreaded "yellow jack" was transmitted solely through the agency of the notorious *Stegomyia* mosquito had been of so many years' standing that the experimental transmission of the virus of this disease by several other species of mosquitoes came as a rather startling confirmation of the predictions of the late Dr. H. R. Carter.

In Dr. Bauer's experiments, *Aedes* (*Stegomyia*) *luteocephalus, A.* (*Aedimorphus*) *stokesi*[5] and *Eretmopodites chrysogaster* were allowed to bite infected rhesus monkeys. After an adequate incubation period, these insects were induced to feed on normal animals and were injected into other test monkeys. All produced fatal infections in the test animals. *A. apicoargenteus* did not transmit the virus. The negative results with this mosquito, a *Stegomyia,* and the positive findings for *Eretmopodites* are especially remarkable.

Continuing studies on West African species I added to the list of experimental vectors three more stegomyiae, *viz., A. africanus, A. simpsoni* and *A. vittatus,* as well as an important domestic mosquito of another genus, *Teaniorhynchus* (*Mansonioides*) *africanus.*[6] *Anopheles gambiae,* the chief malaria carrier of the region, fortunately proved to be incapable of maintaining the virus of yellow fever in its system through the accepted incubation period.

Several other species with which I made transmission tests (unpublished) produced no reaction by bites, but injections of saline suspensions of the vicious crab-hole mosquitoes, *A.* (*Aedimorphus*) *irritans* and *A.* (*A.*) *nigricephalus,* as well as of *A.* (*Banksinella*) *punctocostalis* and *Culex thalassius,* resulted in fatal infections, after the elapse of adequate incubation periods following the initial infecting meal. I was also able to confirm transmission of the virus by *A. luteocephalus.*

In view of the findings in West Africa Davis and Shannon[7] recently reopened the question of the pos-

[1] The studies and observations on which this article is based were conducted in Lagos, Nigeria, with the support and under the auspices of the International Health Division of the Rockefeller Foundation.

[2] W. Reed, J. Carrol and A. Agramonte, Senate Document No. 822, 1911, 110.

[3] E. Marchoux and P.-L. Simond, *Ann. Inst. Pasteur,* 25: 23, 1906.

[4] J. H. Bauer, *Amer. Jour. Trop. Med.,* 8: 261–282, July, 1928.

[5] A correction in name from the original report of *A. apicoannulatus* as pointed out by Evens, *Ann. Trop. Med. and Parasit.,* 23: 521, 1929.

[6] C. B. Philip, *Am. Jour. Trop. Med.,* 9: 267, 1929; 10: 1, 1930.

[7] N. C. Davis and R. C. Shannon, *Jour. Exp. Med.,* 50: 803, 1929.

sible transmission of yellow fever by South American species of mosquitoes other than *Aedes aegypti.*

There are no close relatives of *A. aegypti* in the western hemisphere, but these investigators have shown that *A.* (*Ochlerotatus*) *scapularis* is capable of producing typical infections by biting normal monkeys, that injections of macerated specimens of *A.* (*O.*) *serratus* may result fatally and that injections of *A.* (*Taeniorhynchus*) *taeniorhynchus* produce a mild infection; the bite of the two last-named mosquitoes did not prove infective, however. Negative results had previously been reported in experiments with *A.* (*Taeniorhynchus*) *taeniorhynchus* and *A. scapularis.* No definite infection was obtained by Davis and Shannon with *C. quinquefasciatus,* either by bite or injection; however, three test-animals bitten by these mosquitoes were reported to have remained "relatively immune" when given susceptibility tests.

A total of twenty-five investigations with twenty-two species of mosquito representing five genera has been reported by all the investigators mentioned above. Nine of these species (including *A. aegypti*) transmitted yellow fever by bite; six others transmitted it by injection only; six did not transmit the disease, and in one case (*C. quinquefasciatus*) the result was doubtful. A table is presented below, summarizing the present knowledge with regard to the species of mosquitoes which have been induced to bite infected humans (first two investigations) or monkeys (last three investigations), and have subsequently been tested by bite or injection. *A. aegypti* is included only once, although it has given positive results in the other investigations.

SPECIES OF MOSQUITOES KNOWN TO PRODUCE YELLOW FEVER IN HUMANS AND IN MONKEYS, BY BITE OR INJECTION

Reported by	Total species tested	Positive by bite	Positive by injection only	Negative
Western Hemisphere				
Reed, Carrol and Agramonte	2	1	......	1*
Marchoux and Simond	5	0	......	5†
Davis and Shannon	4	1‡	2†	1*
West Africa				
Bauer	4	3§	0	1
Philip	10	5§	4	1

Species tested in two investigations:

* *Culex quinquefasciatus* (three test animals reported relatively immune by Davis and Shannon).

† *Aedes taeniorhynchus.*

‡ *Aedes scapularis.*

§ *Aedes luteocephalus.*

The number of tests carried out with the crab-hole *Aedes* in Nigeria, as well as the other observations tabulated in the third column of the foregoing table, indicate that in certain species of mosquitoes complete distribution of the virus throughout the body does not occur, under ordinary conditions at least. *A. irritans* has retained the virus for as long as fifty-one days, as proved by subsequent injection, without transfer in biting experiments. Transmission by such unrelated genera as *Eretmopodites* and *Taeniorhynchus* is deserving of note.

While the fight against yellow fever has heretofore proved efficacious in the Americas when centered about control of the *Stegomyia* mosquito alone, increasing information on West African conditions indicates a considerable complexity of factors in that region. It may well be that certain of the potential vectors mentioned above play an important rôle in the dissemination of yellow fever there. This seems all the more likely when one considers that infected persons are probably capable of infecting insect carriers at least a day before the appearance of clinical symptoms. Hudson and Philip[8] have shown that experimentally infected rhesus monkeys may infect mosquitoes one or two days before the onset of fever. If the infective period in humans is similar to that in monkeys mosquitoes would not necessarily have to be house-frequenting species exposed to febrile cases in order to pick up the virus.

Bionomical studies have convinced me that *T. africanus* is the most likely of the potential vectors to be of epidemiological importance in West Africa. It bites humans with avidity, feeds more than once, is present in houses at all seasons in limited numbers and during certain seasons in considerable numbers. Mr. Edwards, of the British Museum, has supplied the information that this species has been captured in the Far East and even in Australia, although its congener, *T. uniformis,* is more abundant in Egypt and through the Orient, as far as the Philippines and Solomon Islands. *T. uniformis* is found occasionally in West Africa and may also be a vector of yellow fever.

It is logical to predict that as further experiments are undertaken several other species of mosquitoes will be found capable of transferring the disease, particularly *Aedes metallicus* and *A. dendrophilus,* both of which are found in moderately large numbers in tree-holes in Nigeria.

CORNELIUS B. PHILIP

[8] N. P. Hudson and C. B. Philip, *Jour. Exp. Med.*, 50: 583, 1929.

ON THE CHEMICAL ECOLOGY OF LAKE TANGANIKA

CUNNINGTON,[1] in his summary of our present knowledge of the natural history of the Great Lakes of Central Africa, has emphasized the unique nature of Lake Tanganika. This lake is distinguished biologically on the one hand by the very large number of endemic species inhabiting it, and by the absence of certain widely distributed organisms on the other. The most noteworthy deficiency concerns the Cladocera, which are entirely lacking from its waters though present in the inflowing rivers.[1,2,3] A similar condition is met with in Lake Kivu.[4] Cunnington, on the basis of analyses given by Stappers,[5] suggests that the absence of Cladocera is due to the large quantity of magnesium present in the waters of the lake. Reference to the literature shows that numerous localities, containing considerably more magnesium than found by Stappers, support a Cladoceran fauna. Recently I have had the opportunity of examining a specimen (135 cc) of coastal surface water from Lake Tanganika which was very kindly collected for me by Dr. Rollin T. Chamberlin, of the University of Chicago. As a result of an examination of this sample and of certain experiments bearing on the problems of the lake the following data can now be presented.

Hydrogen ion concentration.—The pH value of Dr. Chamberlin's sample when opened was 8.7. On boiling, a faint precipitate of alkaline earth carbonates was produced at 9.1. Some decomposition of organic material may have occurred in the water while in the bottle, making it less alkaline than when in the lake. We may conclude that the surface waters of the lake have a pH value between 8.7 and 9.1, and that it probably lies nearer the former figure than the latter. The water therefore is alkaline, but not excessively so, as are some of the smaller Central African Lakes.[6]

Phosphorus content.—Phosphate present in solution after boiling was determined colorimetrically by the cerulomolybdic method; a value of 0.08 milligrams per liter of phosphorus was obtained. It was unfortunately not possible to determine "total" phosphorus, but since the water had been kept a long time before the determination this value probably more nearly approximates to the original "total" than "soluble" phosphorus. It is high when compared with the values for "total" phosphorus (.015–.040 milligrams per liter) obtained by Juday, Birge, Kemmerer and Robinson[7] for the surface waters of the Wisconsin Lakes but is low compared with the large amounts obtained in other alkaline localities, as the Transvaal pans examined by Hutchinson, Pickford and Schuurman[8] (*N. B.*, read .006 grms per liter P_2O_5 for .006 mgms per liter). It appears that at least the coastal waters of the lake do not suffer from a deficiency in this element.

Radioactivity.—In view of recent work on the production of mutations by irradiation it appeared possible that the very high endemicity of the fauna of the lake might be due to an unusual amount of radioactive material dissolved in the water. Gas boiled off from the water sample after it had been sealed for a month gave no indication of radioactivity when transferred to an emanation electroscope.

Toleration of magnesium salts by Cladocera.—Several species of Cladocera have been raised in cultures containing more magnesium than is indicated for Lake Tanganika by Stappers' analyses without ill effects. Moreover both *Daphnia magna* Straus and *D. longispina* O. F. M. have been cultured in solutions made up to contain all the salts of the lake and maintained at a pH of 8.5–8.9. It would appear therefore that other than chemical factors are responsible for the absence of this group from Lake Tanganika.

I am greatly indebted to Dr. R. T. Chamberlin for collecting and bringing back the water sample, and to Dr. Douglas Johnston, of Columbia University, for asking him to do so. I also wish to thank Dr. A. F. Kovarik for lending an electroscope, and the Belgian Colonial Office for a transcript of Stappers' analyses, which are apparently not available in this country.

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[1] Cunnington, *P. Z. S.*, 1920, p. 507.
[2] Sars, *P. Z. S.*, 1909, p. 31.
[3] Gurney, *P. Z. S.*, 1928, p. 317.
[4] Brehm, Wiss. Erb. Deut. Zentr.-Afr.-Exp. 1907, 1908, iii., 1912, p. 167.
[5] Stappers, Renseignements de l'Office Colonial, Bruxelles, 1914, p. 189.
[6] Jenkin, *Nature*, 124: 574, October, 1929.
[7] *Tr. Wisc. Acad.*, 23: 233.
[8] *Nature*, 123: 832, June, 1929.

BOOKS RECEIVED

BAUR, ERWIN. *Einführung in die Vererbungslehre.* 7-11. völlig neubearbeitete Auflage. Pp. vii + 478. 192 figures. 22 tables. 7 colored plates. Verlag von Gebrüder Borntraeger, Berlin. 21,50 M.

BUCKINGHAM, JOHN. *Matter and Radiation with Particular Reference to the Detection and Uses of the Infra-Red Rays.* Pp. xii + 144. 15 figures. Oxford University Press. $3.00.

COMSTOCK, JOHN H., ANNA B. COMSTOCK and GLENN W. HERRICK. *Manual for the Study of Insects.* Revised, nineteenth edition. Pp. xiii + 401. 633 figures. 3 plates. Comstock Publishing Company. $4.00.

EIPPER, PAUL. *Animals Looking at You.* Pp. 163. 152 photographs. Viking Press. $3.00.

HIRSH, NATHANIEL D. *Twins: Heredity and Environment.* Pp. 159. Illustrated. 3 tables. Harvard University Press. $2.00.